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Where is a Moses?* We are all more or less familiar with the Biblical story of how Moses led the Israelites out from under the bondage of the Egyptians at a time when they were sorely depressed, and how they passed through the Red Sea on dry ground to better times, conditions, and how they gained their independence in the Promised Land. During most of this period they were quite dissatisfied with their leader and declaimed against him even though none of them had a better plan or was willing to accept the responsibilities of leadership.

At the present we have been and are, so to speak, passing through our Red Sea of depression, but we hope we are near the farther shore and are about to step out on the shore of better times.

We have had many who claimed to be leaders but their leadership has not been productive of results and we have been tempted to give up in despair as our revenues have failed to meet operating expenses and dividends have been strangers for some time.

It is obvious that in our own industry it is impossible to look to any single leader whose word

*The above article was sent us by a subscriber and we are using it as an editorial because we believe it discusses conditions vital to the welfare of the industry.

is law and who can dominate the policies of the industry. Many plants are locally owned and operated and each operator feels that he has difficulties peculiar to his own plant. What we must strive for is more friendly relations between companies. Attendance at district and state conventions will promote this harmony and will prove mutually beneficial to all who do attend. Where else can telephone men get together and discuss their problems? Where else can the operator of a plant meet his colleagues and learn how they are individually solving their problems? Where else has he the opportunity to hear of the latest developments in the industry as applied to his own plant, with practical discussions of the advantages and disadvantages of each plan which may have been tried? He has the opportunity for learning how the most successful plants are being operated and he is certain to pick up a few good ideas which will be applicable in his own plant.

The successful manager in these days must regard his plant as more than a mere source of revenue for himself or for his stockholders. He must surround himself with enthusiastic employees, who are convinced that they are engaged in the best industry in the land, who are up on their toes, boosters for their company, realizing that its welfare is also their own. The writer has seen telephone employees who by their very attitudes have made enemies for the company. At the same time the manager must remember that he is under obligations to his employees and it is his duty to play fair with them. The policy of laying off men and cutting the working days of those who remain just to maintain a high dividend rate does not leave the employee with the most cordial feeling toward his company. The company which does this is apt to find that when the present crisis is past, many of its better grade employees will seek employment in other fields and the company will be compelled to spend large sums in training new employees.

Many independent companies have more or less neglected some of the newer phases of telephone service. Are there not opportunities for selling extensions, extension bells, P. B. X. boards, intercommunicating systems, private lines, telephone typewriter service, etc., that are being overlooked? Can we not regrade our classes of service upward, showing our subscribers the advantages of single lines over party lines?

Let us be level headed, remembering that there have been other depressions which have run their courses and given way to periods of prosperity. Let each man study his neighbor and exchange ideas with him, let each employer play fair with his employees who will in turn repay him with better service; let us all study our subscribers and their needs with the idea of giving him all the service he requires and the best service that our plant can offer.

Reconstruction of Shanghai System

Following is an Abstract of a Paper Presented Before the Engineering Society of China, January 13, 1932, and Printed by Permission of the Author, Describing Conditions Under Which the Company Worked to Bring About Final Results. Author—J. Haynes Wilson, M. C.

Coincident with the development of Shanghai it has been necessary to take steps to furnish the city with an up-to-date telephone system, and it is the purpose of this paper to indicate in a general way the means taken to do so.

After somewhat prolonged negotiations The Shanghai Mutual Telephone Company was taken over by the International Telephone and Telegraph Corporation and Shanghai Telephone Company came into existence. This Company took the work in hand on August 5, 1930, and gave an undertaking that within two years the Shanghai telephone system would be converted to automatic operation.

On December 13, 1931, 70 per cent of the Shanghai telephone stations were automatic and four new central stations were in operation, namely, Wayside, Pichon, Fokien and Montigny; two more central offices will be opened early in 1932, thus completing the undertaking except for extra Settlement lines, the conversion of which has had to be postponed for political reasons.

Since this paper was delivered, two Rotary Automatic offices have been cut over; North Exchange in February, and West Exchange in March. The cutting over of these exchanges marks the completion, four months ahead of schedule, of the Shanghai Telephone Company's contract with the Municipal Councils to convert Shanghai's telephones to automatic operation.

It became immediately obvious that the programme could not be put through without outside help and the International Telephone and Telegraph system was called upon for suitable specialists—assistance being required for planning, construction, traffic and commercial duties. Assistance arrived from all over the world—57 telephone specialists converging upon Shanghai from Great Britain, United States of America, South America, Japan, etc.

A new organization was built up and new labour recruited, resulting in an increase of staff employed by Shanghai Telephone Company from 3,180 to 4,137 persons within six months.

Table No. 1
Building Particulars

Exchange	Present Building Capacity lines	Equipment lines	Building Completed
Pichon	10,000	4,000	1 Apr. 1930
Fokien	20,000	5,000	4 Oct. 1930
Wayside	10,000	5,000	15 Dec. 1930
North	20,000	7,000	14 Apr. 1931
West	20,000	6,000	30 July 1931
Montigny	20,000	6,000	16 Mar. 1931

Three London installers who had been engaged upon an extension to the

existing Central automatic exchange were available in Shanghai and within six months from the contract being placed fourteen additional experts arrived to assist in supervision and training. Of these, four came from Paris, six from Antwerp, and one each from Cairo, Peru, United States of America, and Rio de Janeiro.

Pending the arrival of automatic equipment, steps were taken to train local help—Chinese students returned from United States of America, Russians and others were engaged for special work or junior supervisors. By good fortune several men were found who had performed duties in telephone exchanges in various parts of the world.

Men with some training in the use of tools were recruited and trained for special work such as erecting apparatus, running cables, simple wiring, switch adjusting and so on. The China Electric Company's factory in Chapei was called upon to supply as many trained wiremen as could be spared and additional assistance was given by the Shanghai Telephone Company who sent men into each of the new exchanges during the installation period in order that they might become familiar with the equipment and thus be better able to maintain it after it was brought into operation.

Cable Vault

Entry to the central office is always effected by means of underground cables which may contain up to 1,200 pairs of wires. Subscribers and inter-exchange cables are concentrated in the cable vault, which is located immediately below and parallel to the main distribution frame. This vault is designed to facilitate tidy termination and to provide protection against fire or mechanical injury.

Since the street cables are of large size and are insulated with paper, they are not suitable for direct termination on the main distribution frame, and consequently it is necessary to splice these cables into a number of smaller cables which are insulated with silk and cotton; this splicing is carried out in the cable vault.

The street cables leave the cable vault to feed the distribution network, and they radiate in all directions from the exchange through duct routes built up of 3, 6, 9, 12 or 15 ducts.

Ducts

In addition to 340 duct miles which already existed in 1930, a total of 40 duct miles has been laid during the re-construction period.

Concrete ducts, vitrified clay ducts, iron pipes, and in some cases fibre conduit have been used in this work, some of the ducts having been manufactured in our own yards, while others were imported.

At intervals along the duct routes are wells or manholes, which, whenever possible, are constructed to certain standards which have been proved to be the most suitable for particular conditions.

In many cases the standard well could not be built due to what one might call the rather unsystematic arrangement of the pipes, drains, cables, etc., which were buried underground many years ago by the various Utility Companies and others, not excluding the Telephone Company. For example, in one particular case, it was necessary to sink a well 12 feet underground in order to clear a sewer.

In certain instances the old ducts were found to be full of mud, and in order to clear out this accumulation the P. W. D., the water works company and the fire brigade were called upon to assist in an experiment of flushing the ducts with water. This proved successful, it being found that 40 lbs. pressure of water cleared of obstruction approximately 100 yards of duct.

The main feeder cable, which is a very expensive item, usually provides for not more than from five to eight years development of the area which it is designed to serve; but it is so arranged that the initial area may, at a later date, be subdivided into two or more ultimate areas; the additional area or areas being served by new feeder cables. The initial feeder cable is so planned that it can be picked up by the new cable at some prearranged point, without altering its physical lay-out.

This is accomplished by placing stubs in the feeder cable at points where distribution cable connections are, or will be required. The arrangement is such that all the pairs in the feeder cable are available in the stubs designed to serve each ultimate area.

The distribution boxes used on the block and aerial systems are of a type specially designed to prevent the ingress of moisture to the cable. Lengths of dry core, paper insulated stub cables containing from 10 to 20 pairs are supplied ready connected to these boxes, the free ends of these cables being joined to cables led from the main feeder cable.

Inside the box the stub cable connections are effectively sealed from contact with the atmosphere in order to guard against the lowering of the insulation of the cable.

Previous to the re-construction, the distribution network had become congested and had lost its flexibility; and consequently in order to meet the demand for service, individual wires had frequently to be run, not to the nearest terminal, but to the nearest one containing spare cable pairs. This resulted in an excessive use of drop or lead-in wires, some premises being served from points which, from a distribution aspect, were certainly not in the vicinity.

Additional points of distribution and re-routing necessitated different points of entry into subscribers' premises, resulting in very many cases, in the re-wiring of the installation from the point of entry to the telephone; more than 700,000 feet of wire have been used for this work alone.

During the work of re-constructing outside plant, a high standard of distribution was set, and whenever such a procedure was economically sound, telephone lines have been transferred from overhead to underground, or from open wire to aerial or block cable, thus introducing the benefits of greater permanency and less liability to interruption, and also resulting in lower maintenance costs.

Up to the present 1,300 poles have been removed and 500 more are scheduled to be taken down in the near future. 430,000 feet of underground cable, 840,000 feet of aerial cable and 6,500 new distribution boxes have been placed up to date.

Subscribers in the 60,000 and 70,000 groups of numbers were already operating on what is known as the Common Battery System ,and in these cases the existing instrument was rendered suitable for automatic working merely by fitting a dial. Some 3,500 dials have been fitted to instruments of this type. In the case of the magneto instruments, the question of conversion was not so simple, in that every instrument had to be entirely replaced.

Subscribers' Private Branch Exchanges were changed prior to the actual conversion to automatic working, special arrangements having been made to permit the new type board operated over the old central office until the changeover took place.

Up to the present approximately 800 magneto P B Xs have been replaced by the new types.

Cable Arrangements

Further operations in connection with the conversion of the subscribers' apparatus were necessary in order to make the distribution network accessible to both the old and the new exchanges.

Two methods were adopted for this purpose: One method was to divert the old lines into the new exchange building, and then to connect them via the new exchange main distribution frame and back by a special cable to the old exchange. The other method

(*Continued on page* 33)

VACUUM TUBE THEORY AND PRACTICE

SUBJECT: SOUND PROJECTION PRACTICES PART V

Subject: **Power Level Indicators**

General

This article, which is the fifth of a series of articles on Sound Projection Practices, discusses the *power level indicator which* is an essential piece of equipment in any sound projection system.

Preceding articles in the October, 1931, issue, and March, April, June and July, 1932, issues of Telephone Engineer have covered pick up apparatus, mixer control panels, voltage amplifiers, and power amplifiers. It will be noted that the various units in a sound projection system have been discussed in the same order that they appear in a working system.

Purpose of the Power Level Indicator

In operating a sound projection system it is necessary to have some means of measuring the power level supplied to the projectors, in order that the sound output may be maintained at a uniform volume, once the proper level for a given installation has been determined.

The power level indicator is the instrument used to measure the audio power output of a power amplifier thus giving the operator a visual indication of the sound output of the projectors so that the voltage or power amplifier may be adjusted to give the desired volume. (note—power level indicators are also known as "volume indicators".)

The power level indicator consists of an electrical instrument which is connected across the output circuit of the power amplifier and which indicates by means of deflections of a meter needle, the average power level in the circuit to which the indicator is bridged.

The measurement of power in a circuit carrying alternating current of voice frequency and variable amplitude is not an exact process, inasmuch as the meter needle fluctuates quite rapidly, especially on speech programs. The approximate average maximum power can be readily determined, however, by noting the average maximum deflection of the indicator needle over a period of ten to fifteen seconds. The accuracy of this method is sufficient for the purpose for which the volume indicator is normally used.

Theory of the Power Level Indicator

The power level indicator is an instrument which shows the approximate average maximum power level of the circuit across which it is connected. It is merely an A. C. voltmeter which is calibrated in decibels or watts rather than volts. There are two basic types of power level indicators in common use, which are:

1.—The vacuum tube power level indicator.

2.—The rectifier type power level indicator.

The vacuum tube type is the older of the two and has been in use for a number of years.

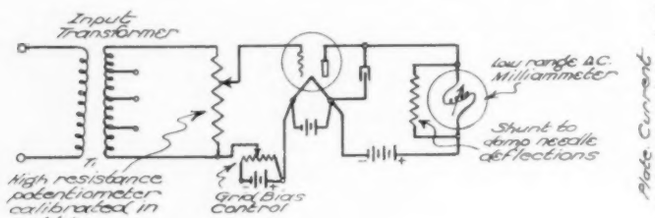

Input Transformer
Low range D.C. Milliammeter
Shunt to damp needle deflections
High resistance potentiometer calibrated in d b's.
Grid Bias Control

Fig. 1. Schematic circuit of vacuum tube type of power level indicator.

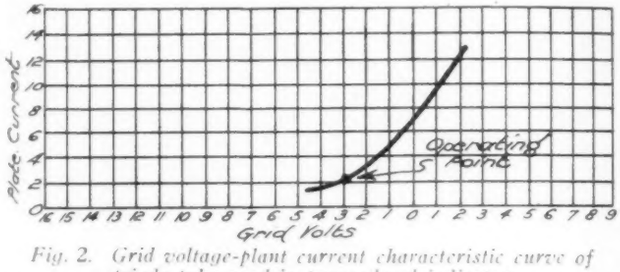


Fig. 2. Grid voltage-plant current characteristic curve of triode tube used in power level indicator.

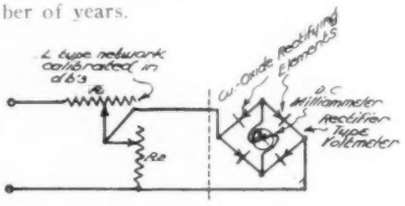


Fig. 3. Schematic circuit of rectifier type power level indicator.

It consists essentially of an input transformer, a calibrated potentiometer, a vacuum tube (usually a triode), a sensitive D. C. milliameter, and a source of power for filament and plate.

Figure 1 illustrates schematically the circuit used in the majority of power level indicators of the vacuum tube type.

The theory of operation of this type of indicator is as follows:

The vacuum tube is operated with sufficient negative grid bias to throw the operating point of the tube down on the lower bend of the grid voltage—plate current characteristic curve. The transformer (T_1) shown has its input winding bridged across the circuit to be measured. The A. C. signal voltage across the circuit being measured induces voltage across the secondary of the transformer which is impressed on the grid of the tube. Inasmuch as the tube is operating on the lower bend of its characteristic curve, the D. C. plate current increase on positive half cycles will be much larger than the D. C. plate current decrease on negative half cycles. The net effect of the applied "program" voltage will therefore be an increase in the normal plate current flowing in the plate circuit and this change in plate current will be indicated by an upward deflection of the D. C. meter in the plate circuit.

Inasmuch as the change in plate current is proportional to the magnitude of the A. C. voltage applied to the grid it is obvious that the vacuum tube volume indicator is merely an A. C. voltmeter.

The input transformer has a very high impedance hence draws very little energy from the circuit to which it is connected.

The vacuum tube type of level indicator has two advantages over other types of A. C. voltmeters, which make it particularly well adapted for measuring voltage on high impedance circuits, these advantages are:

1.—The input impedance is exceptionally high, hence the instrument draws very little power from the source being measured.

2.—The response is fairly uniform over a wide frequency range.

Calibration of Vacuum Tube Power Level Indicator

Vacuum tube power level indicators are usually calibrated in decibels, although instruments have recently been placed on the market which are calibrated in watts. The actual range of the D. C. meter used in this type of power level indicator is only a few decibels, however, the range of the instrument is extended either by means of a tapped secondary winding on the input transformer, or by means of the potentio-

meter arrangement shown in Figure 1. The total range in decibels of the average power level indicator extends from ten to fifteen dbs. below zero level to 35 to 40 dbs. above zero level. Zero level is usually taken as 0.006 watts. Inasmuch as the power level corresponding to a given voltage deflection on the meter, depends on the impedance of the circuit across which the indicator is bridged, it is necessary that power level indicator be calibrated for use on circuits of some specified impedance. If used on a circuit of any other impedance then a correction factor must be used.

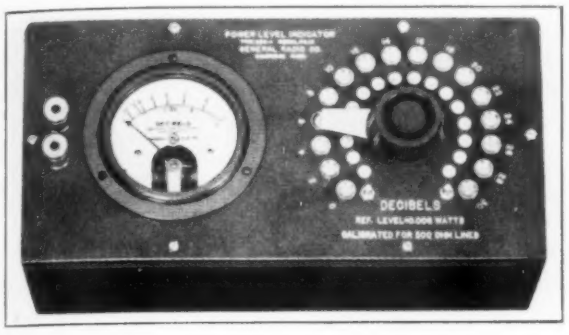


Fig. 4. General radio power level indicator.

The Rectifier Type Power Level Indicator

The invention of the copper oxide rectifier type meter several years ago made possible a new type of power level indicator which is quite popular and which offers certain advantages over the vacuum tube type power level indicator.

The rectifier type power level indicator consists essentially of a variable L type resistance network connected to a high impedance rectifier type voltmeter. The characteristics of the rectifier type voltmeter were discussed quite fully in the December, 1931 issue of Telephone Engineer in an article titled "Transmission Measurements". The two principle features of the rectifier type meter are that they can be used on frequencies up to 30,000 cycles and that voltmeters having impedances of several thousand ohms per volt are available. Prior to the invention of this type of meter, no suitable A. C. voltmeter having high impedance characteristics was available.

Figure 3 illustrates the circuit of the rectifier type of power level indicator and in Figure 4 is shown a General Radio Type 586-A instrument which is typical of this type of level indicator. The terminal impedance of this instrument is 5000 ohms and is constant regardless of the setting of the L type variable network. The variable network serves as a potentiometer and thus serves to extend the measuring range of the instrument. It will be noted that the constant impedance at the input terminals of the instrument is provided by an arrangement which cuts resistance out of R_1 and into R_2 or vica versa when the calibrated arm is varied.

The instrument is calibrated in decibels using 0.006 watts as zero level.

The range of the meter with the variable network set on zero is from negative 10 dbs. to plus 6 dbs. The range can be extended to plus 36 dbs. by means of the variable network. Plus 36 dbs. represents a power of approximately 23.8 watts and negative 10 dbs. a power of 0.0006 watts.

Like the vacuum tube type of power level indicator, it is necessary to calibrate the rectifier type indicator for use on lines of some stipulated impedance. The instrument shown is calibrated for use on 500 ohm lines. By means of a correction chart furnished with the instrument it may be used across circuits having a higher or lower impedance than 500 ohms. This type of power level indicator can be used on frequencies up to 10,000 cycles without appreciable error. The advantages of this type of instrument over the vacuum tube type is its permanency of calibration, no batteries required, and it is much more rugged and compact than the former type. It has one disadvantage, viz.: the impedance load which it presents across the circuit to which it is connected is relatively low as compared to the vacuum tube power level indicator, hence it is desirable that it be used across relatively low impedance circuits in order to get readings.

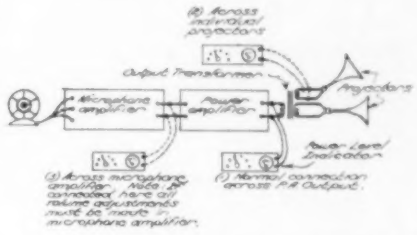


Fig. 5. Schematic diagram of method of using power level indicator.

Method of Using Power Level Indicators

The power level indicator is generally connected across the output of

For Current or Voltage Ratio	For Power Ratio	Amplification Ratio	Attenuation Ratio	For Current or Voltage Ratio	For Power Ratio	Amplification Ratio	Attenuation Ratio
1	0.5	1.122	0.891	51	25.5	355	0.00282
2	1.0	1.259	0.794	52	26.0	398	0.00251
3	1.5	1.413	0.708	53	26.5	447	0.00224
4	2.0	1.585	0.631	54	27.0	501	0.00200
5	2.5	1.778	0.562	55	27.5	562	0.00178
6	3.0	1.995	0.501	56	28.0	631	0.00158
7	3.5	2.24	0.447	57	28.5	708	0.00141
8	4.0	2.51	0.398	58	29.0	794	0.00126
9	4.5	2.82	0.355	59	29.5	891	0.00112
10	5.0	3.16	0.316	60	30.0	1000	0.00100
11	5.5	3.55	0.282	61	30.5	1120	0.000891
12	6.0	3.98	0.251	62	31.0	1260	0.000794
13	6.5	4.47	0.224	63	31.5	1410	0.000708
14	7.0	5.01	0.200	64	32.0	1580	0.000631
15	7.5	5.62	0.178	65	32.5	1780	0.000562
16	8.0	6.31	0.158	66	33.0	2000	0.000501
17	8.5	7.08	0.141	67	33.5	2240	0.000447
18	9.0	7.94	0.126	68	34.0	2510	0.000398
19	9.5	8.91	0.112	69	34.5	2820	0.000355
20	10.0	10.0	0.100	70	35.0	3160	0.000316
21	10.5	11.2	0.0891	71	35.5	3550	0.000282
22	11.0	12.6	0.0794	72	36.0	3980	0.000251
23	11.5	14.1	0.0708	73	36.5	4470	0.000224
24	12.0	15.8	0.0631	74	37.0	5010	0.000200
25	12.5	17.8	0.0562	75	37.5	5620	0.000178
26	13.0	20.0	0.0501	76	38.0	6310	0.000158
27	13.5	22.4	0.0447	77	38.5	7080	0.000141
28	14.0	25.1	0.0398	78	39.0	7940	0.000126
29	14.5	28.2	0.0355	79	39.5	8910	0.000112
30	15.0	31.6	0.0316	80	40.0	10000	0.000100
31	15.5	35.5	0.0282	81	40.5	11200	0.0000891
32	16.0	39.8	0.0251	82	41.0	12600	0.0000794
33	16.5	44.7	0.0224	83	41.5	14100	0.0000708
34	17.0	50.1	0.0200	84	42.0	15800	0.0000631
35	17.5	56.2	0.0178	85	42.5	17800	0.0000562
36	18.0	63.1	0.0158	86	43.0	20000	0.0000501
37	18.5	70.8	0.0141	87	43.5	22400	0.0000447
38	19.0	79.4	0.0126	88	44.0	25100	0.0000398
39	19.5	89.1	0.0112	89	44.5	28200	0.0000355
40	20.0	100	0.0100	90	45.0	31600	0.0000316
41	20.5	112	0.00891	91	45.5	35500	0.0000282
42	21.0	126	0.00794	92	46.0	39800	0.0000251
43	21.5	141	0.00708	93	46.5	44700	0.0000224
44	22.0	158	0.00631	94	47.0	50100	0.0000200
45	22.5	178	0.00562	95	47.5	56200	0.0000178
46	23.0	200	0.00501	96	48.0	63100	0.0000158
47	23.5	224	0.00447	97	48.5	70800	0.0000141
48	24.0	251	0.00398	98	49.0	79400	0.0000126
49	24.5	282	0.00335	99	49.5	89100	0.0000112
50	25.0	316	0.00316	100	50.0	100000	0.0000100

Fig. 6. Table of decibels vs. power voltage and current ratios.

the power amplifier, or across individual projectors. Where the output level of the power amplifier exceeds the range of the power level indicator, it may be desirable to connect it across the output of the microphone amplifier. Figure 5 illustrates the various points in a sound projection system where the power level indicator may be connected. In connecting a power level indicator across a circuit in order to measure the power in the circuit two things must always be kept in mind, viz.:

1. The power level indicator is calibrated for circuits of some specified impedance. If the circuit to which the indicator is bridged does not have approximately this same impedance then a correction factor must be applied. This factor for a power level indicator calibrated in decibels is as follows:

$$N = 10 \log_{10} \frac{Z_C}{Z_1}$$ Where:

N —correction in dbs.
Z_C—impedance for which indicator is calibrated.
Z_1—impedance of circuit on which it is used.

2. With power level indicators of the rectifier type the effect of bridging the indicator is several times as great as the impedance of the source across which it is bridged.

There are two ways in which the power level indicator can be used to determine the output power that should be fed into the projectors. One method is to assume that a certain type of installation will require a given power level, in accordance with empirical data available, and adjusting the output of the power amplifier to give this output as indicated by the power level indicator. The second method, which is the one most generally used, consists in determining by preliminary listening tests the approximate volume required to properly serve a given installation and then noting the power output as measured by the power level indicator.

The output power is then maintained at the level determined by the listening tests except that it is usually necessary, during the operation of a system, to make slight changes in the power level because of the absorption effect of the audience, effect of wind (outdoor installations), and the character of the program material.

The power level required to serve an auditorium filled with people is generally somewhat greater than that required where only a few people are present.

On outdoor public address installations the output level required to satisfactorily serve a given area will be greater where wind or considerable exteraneous noise is present.

Computations In Connection with Power Level Indicators

In working with sound projection systems and particularly in connection with the output stage of the power amplifier it is desirable that the operator of such a system be fairly familiar with certain equations dealing with the relationship between the db., power, voltage, and impedance. The most useful of the equations are discussed in the following paragraphs.

It is the practice of the majority of the amplifier manufacturers to express the output power of their equipment in terms of watts, however, a few express power output in terms of "decibels above zero level." Zero level is commonly taken as 0.006 watts.

Of the two methods the expression of power output in terms of decibels is the more logical, as it permits a more ready comparison of various amplifiers, as it has been established that the ear cannot distinguish the difference in volume between two sounds unless than they differ at least 1 or 2 db. Hence the db. has a quantitative significance with respect to sound output which makes it particularly useful. Where the power output of an amplifier is expressed in decibels and it is desired to know the power in watts, the decibel rating should be referred to a table of dbs vs. power ratio (as shown in Fig. 6) and the corresponding power ratio multiplied by 0.006 watts to get the output of the amplifier in terms of watts.

For example an amplifier having a power output rating of plus 40 db would have a power output in watts of $0.006 \times 10{,}000 = 60.0$ watts.

The conversion of power in watts to dbs is obviously the reverse of the above process, viz., divide the power in watts by 0.006 to find the power ratio, then refer the power ratio obtained to the table Fig. 6 to determine the power in dbs.

For example an amplifier having a rating of 10 watts would be converted to a db rating as follows:

$$\frac{6}{0.006} = 1000$$

Referring the power ratio 1000 to the table we get 30 db.

Figure 6 is a table of decibels vs. power, voltage, and current ratios.

Other equations of use in working with power amplifiers and power level indicators are as follows:

1. (a) $P = \frac{E^2}{Z}$ (b) $E = \sqrt{PZ}$ (c) $Z = \frac{E^2}{P}$

2. (a) $P = I^2 Z$ (b) $I = \sqrt{\frac{P}{Z}}$ (c) $Z = \frac{P}{I^2}$

Where:
P—Power in watts.
Z—Impedance in ohms.
E—Voltage in volts.
I—Amperage in amperes.

The first equation is useful where the output voltage of a power amplifier is measured across the load impedance, and it is desired to find the power output in watts. Using equation 1-a and one of the new rectifier type voltmeters, a power level indicator can be fixed up using a conversion chart to show the power in watts or dbs for any voltage within the range of the voltmeter. For example to determine the dbs corresponding to a reading of 5 volts on a rectifier type voltmeter used on a circuit of 500 ohms impedance, we would first find the power in watts by means of equation (1-a) i.e.,

$$P = \frac{E^2}{Z}, \text{ or } P = \frac{5^2}{500} = 0.05$$

then obtaining the ratio of this power to zero level of 0.006 watts we get $\frac{0.05}{0.006} = 8.32$ and referring this power ratio to the table in Figure 6 we find that 5 volts would correspond to 9.3 decibels. It is thus apparent that a voltmeter may be readily calibrated in terms of decibels by means of a few simple computations.

The second form of equation 1-b is convenient for computing the A. C. voltage which would be developed across the load impedance of a vacuum tube, where the output power is known. As an example of the use of this equation, assume that it is desired to know the voltage that will be impressed across the load impedance of a 250 type tube when operated at maximum undistorted output. From the manufacturers rating of the 250 tube we would find that it has a maximum undistorted output of 4.6 watts and that it should be used with a load impedance of 4350 ohms solving for the voltage across the load using equation 1-b we would get

$E = \sqrt{PZ}$ or $E = \sqrt{4.6 \times 4350} = 142$ volts.

The third form (1-c) of equation No. 1 can be used to determine the impedance of any A.C. source of power by measuring the voltage across a variable impedance and adjusting the impedance for maximum power transfer. The internal impedance of the source can then be found by solving for Z in the equation 1-c.

The second set of power equations are less useful than the first set as the measuring instrument ordinarily available are not suitable for measuring voice frequency currents of low magnitude.

Telephone Activities in Foreign Countries

Dispatches from Abroad Keep Telephone Men in United States Constantly Informed Concerning Telephony of the World; Domestic Telephone Problems Oftentimes Can Be at Least Partially Solved by Watching the Outcome of Experiments Made Elsewhere

Cuban Postal and Telegraph Rates Reduced

Cuban postage rates on postal cards, third class mail and the fee for registered mail have been restored to those applicable prior to the emergency tax law of January 29, 1931, and similarly the domestic telegraph rates. No changes have been made, however, in the rate applying to first class mail, which remains at 3 cents per ounce or fraction of an ounce, or to the rates charged for money orders. It is stated that the increased rates brought about a sharp reduction in the revenues of these items and for that reason the former rates have been restored.

New Telephone Circuit Between North America and South Africa

Regular Radiotelephone Service between North American telephones and South Africa was established June 1, via London. The total length of the circuit from New York to Cape Town is about 9,500 miles.

Russia Has Telephone Service with Germany and England

Telephone service between all places in Germany and Moscow and Leningrad was introduced in April. A direct circuit is provided between Berlin and Moscow. A service between Great Britain and Moscow was opened early in May.

South Africa Effects Further Extensions of Wireless Telephone Connections

The Postmaster General has just announced that overseas telephone communication from offices in the western part of the Cape Province, and Port Elizabeth, has now been extended to the principal European countries. These new connections include Belgium, Ceuta (North Africa), Czechoslovakia, France, Germany, Gibraltar, Netherlands, Irish Free State (Dublin only), Italy, Spain, Switzerland, and the Vatican State.

Delhi, India, to be Connected by Telephone with Various Provincial Capitals

Plans are nearing completion for linking up Delhi by telephone with the various provincial capitals. The Bombay-Calcutta direct line has been successfully tested. Interest is now centered on the Delhi-Madras link, which when completed, will be the longest trunk line in India.

Prague Telephone Service to be Expanded by Reduced Fees

The Czechoslovak State Telegraph and Telephone Administration has announced that the fee of 1,000 crowns ($30) for the installation of a telephone in the city of Prague will be reduced by 50 per cent (500 crowns). If two parties living in the same house apply for telephones, the fee will amount to only 30 per cent (300 crowns) for each, and if three or more persons in the same house make applications, the fee will be only 25 per cent (250 crowns) for each applicant. A new category of telephone stations are to be introduced, for which a monthly amortization fee of 50 crowns ($1.50) and a charge of 0.80 crowns ($0.24) for each call will be paid. The present minimum monthly subscription fee amounts to 110 crowns ($3.30) and permits not more than 80 calls monthly; a special charge of 0.40 crowns ($0.12) is charged for each additional call.

Hungary Lowers Telephone Installation Fee

The Hungarian Postal Administration, operators of the Hungarian telephone system in a recent decree lowered the installation fee for new telephone subscribers in Budapest from 240 pengo to 120 and in the outlying district from 80 pengo to 48. (1 pengo equals $0.175). This decree was enacted in connection with the recent drive to increase the number of subscribers. To this end also an information booth was opened at the Budapest International Fair; special facilities were provided for a speedy installation of the equipment for those who file their application there.

Additional Cables to Connect British, French and Belgian Telephone Systems

Preparations are being made for the laying of additional cables to connect the British with the French and Belgian telephone systems, and the building of a new repeater station at St. Margarets-at-Cliffe, on the coast near Dover, is to commence at once.

Expansion in Swedish Telephone Business During 1931

The Swedish Telegraph Administration states that the number of telephones in Sweden increased by 23,999 during 1931 to a total of 546,453 almost one telephone for every ten inhabitants. Telephone calls between Sweden and all foreign countries except Norway, Germany and Finland increased in 1931. Calls between Sweden and non-European countries showed the largest increase, no less than 90.9 per cent. Sweden established telephone connections with Soviet Russia, Roumania, French Morocco, Canary Islands, Siam and Venezuela during the year.

New Telephone Line in Argentina

A very interesting development of recent months is the completion of a telephone line connecting Corrientes and the Chaco with the Federal Capital of Buenos Aires. This project was started in 1929 and carried to completion by the Cia. Argentina de Telefonos and the Cia. Internacional de Telefonos and will eventually include Misiones and the Republic of Paraguay. The line used is one of the longest yet introduced in Argentina, covering a stretch of 1,123 kilometers to Corrientes and another 500 kilometers across the Chaco.

Austrian Postal, Telegraph and Telephone Receipts Decline 22 Per Cent

As a result of the general crisis the receipt of the postal, telegraph and telephone service have declined about 22 per cent as compared with a year ago, and the first quarter of the current year closed with a deficit of 7,500,000 schillings. (The schilling equals approximately $0.1396 at the current rate of exchange). It is planned to put through vigorous economy measures to balance the budget of the postal telegraph and telephone service. Long distance calls have greatly diminished. The new method of recording telephone calls and calculating costs by units of time has also caused a sharp decline in the volume of telephone calls.

Subscribers' Wireplant in Toll Center District

This is the Fourth Article of the Series on "A Development Study of the Toll Center District", wherein the Method of Connecting the Subscribers to the Office is Given; wherein It is Also Explained How the Transmission Loss is Determined. By F. J. Dommerque.

Cooperation

Hand in hand with Coordination goes Cooperation. The planned consolidation of railroads furnishes a good example for cooperation to achieve economy in railroad operation, that is, in mechanical communication. In electrical communication the Bell System has reached the highest perfection of cooperation by the affiliation of the A. T. & T. Co. with its associated subsidiaries. The companies in a toll center district cannot do better than follow suit; a combination in several neighboring toll centers would be still better.

The economy resulting for instance from a joint poleyard for all the exchanges in the district is so evident that it needs no further explanation. In the exchange equipments standardization could be brought about with a wonderful economy in buying, storing, reserve parts, etc., etc. Standardization of operating, rates, bookkeeping, collections, all would effect simplification. And last but not least the administration expenses would be curtailed and the operation of the toll center district made easier by standard methods of labor, based upon one standard of equipment. In our development study we consider the toll center district with its exchanges as one standardized unit.

Subscribers' Line Cableplant

Having the map with the future number of subscribers inscribed in each block before us, the subscribers are then collected in cable runs, assuring that even the smallest exchange is using an all-cable plant. The residence district at the outskirts of the community will be served extensively by party lines and therefore the most useful distribution to render this party line service flexible, will be multiple cabling.

The smallest aerial cable contains 5 pairs, nominally; in reality, 6 pairs, one pair being in reserve, as in cables always reserve pairs are provided. A 50-pair cable has two reserve pairs, the smaller cables mostly one. The next larger aerial cables are 10-pair and 15-pair; then the 25-pair and so on. Of course, the distributing boxes are also provided with terminals for the reserve pairs. One should not save on distributing boxes in order to render the cables accessible at numerous

NOTE. Former installments of this series have appeared in* Telephone Engineer *during the past few months. Other installments will follow until the entire series is completed.

places. As one never knows, where the distributing cables have to take on the greatest number of subscribers in the future, it has become customary to let the small cables run to the end of the line, but open them at each distributing box. With larger cable, for instance with a 50-pair cable, one can proceed as follows: Assuming the cable has to run along six blocks, that is, it would cross five parallel streets; in this case six distributing boxes for 15 pairs each are provided, one for each block.

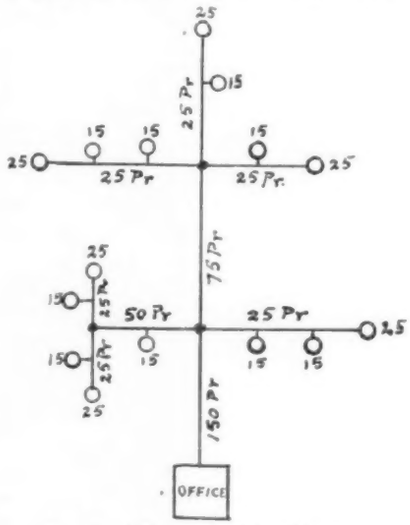


Fig. 1. 150-*pr. Aerial cable run.*

At the first box the 16 innermost pairs of the cable are connected, numbered 1 to 16. At the second box the pairs 17 to 32 and at the third box, the pairs 33 to 48. If there is demand for it, one or more 11-pair boxes can be placed between the 16-pair boxes. At each 11-pair box, 5 pairs are taken out of a 16-pair bunch in such a manner, that the same 5 pairs are multiplied at some and other 5 pairs at other distributing boxes; the principle is to render the same 5 pairs accessible at several boxes.

The bunches of pairs 17 to 32 and 33 to 48 are distributed in the same way. This completes the distribution of 50-pair cable over three blocks. Next the same distribution is repeated at the three other 16-pair boxes and intermediate 10-pair boxes, thus obtaining for one and the same cable two equal distribution groups. If later on the pairs in the three first blocks are taken up and further pairs are required, the two equal groups are separated at the third 16-pair box and the cableend is extended and brought to the office in a feeder or supply cable; thus the original layout is not disturbed at all.

It is not advisable to carry more than two cables on the same poleline; then it will be the time to lay the cables underground. No reserves in the cables are required in multiple cabling.

In exchange of the size found in a toll center district not many will have underground distribution in the residence district; but there may be some, particularly the toll center itself, where considerable underground distribution may be required. Where underground cables run from the office manhole, there must always some reserve be provided, amounting from 20 to 50% according to size of cables and conduits; for instance: in a 400-pair cable, where no other cables are laid in the same conduit, 50% reserve is provided, that is, 200 pairs are retained for reserve. In a conduit containing five 400-pair cables, 400 pairs reserve suffice, that is 20% reserve. The same percentage holds good, if there were 600-pair cables instead of 400-pair. There are cases, where in large size plants with ten 600-pair cables in one conduit a 15% reserve has been considered sufficient. It hardly needs mentioning that in each conduit, sufficient ducts for the subscribers to be expected in the twenty years are to be provided, but cables only drawn in as and when required.

Of course, there are all kinds of multiple cable combinations to suit all kinds of situations.

In Fig. 1 an aerial cable run is shown of a 150-pair cable starting from the office and terminating in distributing boxes. This run proceeds in one direction, other similar cables extend in

other directions. The one in Fig. 1 will give an idea of the arrangement.

The size or gage of the cable conductors depends solely on the transmission requirements. Previously we assumed a tentative transmission loss equivalent to 4 db for a subscriber's line; consequently the cables must be in the whole or in parts so calculated that their transmission equivalent does not exceed the specified amount.

Transmission Equivalents

	Transmission Equivalent db per Mile
Open Wire	
No. 6 American Wire Gage, copper wire	0.038
No. 8 American Wire Gage, copper wire	0.055
No. 9 American Wire Gage, copper wire	0.061
No. 9 American Wire Gage, copper wire, phantom	0.051
No. 10 American Wire Gage, copper wire	0.078
No. 12 American Wire Gage, copper wire	0.11
No. 12 N. B. S. Wire Gage, copper wire (104 mils.)	0.076
No. 12 N. B. S. Wire Gage, copper wire (104 mils.) phantom	0.063
No. 8 Birm. Wire Gage, copper wire (165 mils.)	0.033
No. 8 Birm. Wire Gage, copper wire (165 mils.) phantom	0.027
No. 10 Birm. Wire Gage, iron wire (134 mils.) B. B.	0.23
No. 12 Birm. Wire Gage, iron wire (104 mils.) B. B.	0.30
No. 14 Birm. Wire Gage, iron wire (83 mils.) B. B.	0.038
No. 14 N. B. S. Wire Gage, copper wire (80 mils.)	0.114
No. 14 N. B. S. Wire Gage, copper wire (80 mils.) phantom	0.1
No. 9 N. B. S. Wire Gage, copperclad wire (47%)	0.116
No. 10 N. B. S. Wire Gage, copperclad wire	0.14
No. 12 N. B. S. Wire Gage, copperclad wire	0.192
No. 14 N. B. S. Wire Gage, copperclad wire	0.266
Cable (500 magohm insulation resistance).	
No. 10 American Wire Gage, mutual capacity 0.074 mf.	0.37
No. 10 American Wire Gage, phantom	0.33
No. 13 American Wire Gage, mutual capacity 0.074 mf.	0.52
No. 13 American Wire Gage, phantom	0.465
No. 14 American Wire Gage, mutual capacity 0.074 mf.	0.59
No. 14 American Wire Gage, phantom	0.52
No. 16 American Wire Gage, mutual capacity 0.074 mf.	0.74
No. 16 American Wire Gage, phantom	0.66
No. 19 American Wire Gage, mutual capacity 0.074 mf.	1.15
No. 19 American Wire Gage, phantom	0.94
No. 22 American Wire Gage, mutual capacity 0.07 mf.	1.45
No. 22 American Wire Gage, phantom	1.29
No. 22 American Wire Gage, mutual capacity 0.083 mf.	1.58
No. 22 American Wire Gage, phantom	1.45
No. 24 American Wire Gage, mutual capacity 0.083 mf.	2.115
No. 18 American Wire Gage, bridle wire	1.52
No. 14 American Wire Gage, rubber covered copper distributing wire	0.076
A repeating coil for phantom	0.74

Transmission Notes

To use the above cited transmission equivalents for determining the conductorgage to be chosen, it is presupposed that there is no resistance in the circuit in excess of the resistance of the telephone instrument and perhaps of the repeating coil. There may be such an excess in the subscriber's loop of a common battery circuit, which would cause a loss, which can be stated as follows: With only 4 volts across the common battery transmitter at the subscriber's station the current supply loss would equal 1.59 db; with 3 volts 3.98 db; with 2 volts 7.42 db and with only 1.25 volts 13.25 db.

As long as at a local battery telephone station the batteries have their full voltage, no current supply loss will occur; therefore, great care should be taken principally with form lines, that the batteries are promptly received.

Farm lines are a difficult proposition in connection with toll service. First of all the farm lines still have a great deal of iron wire, which, as the foregoing table shows, has a much higher transmission loss than copper wire; for instance, the loss in No. 14 iron wire is more than three times the loss in No. 14 copper wire. Furthermore the figures given for the losses in the table hold good only in case the iron wire is new. After a number of years the wire will be deteriorated to such an extent that its transmission loss will be doubled. Thus a farmer can not expect far reaching toll service as long as he has iron wire. But aside from that, it may be expected that the farms of the future will demand better accommodation and will be willing to take regular common battery harmonic ringing service over copper circuit with fewer on the line. If then the lines should still be too long to talk over the entire toll center district and to the nearest primary outlet, the telphones may be provided with dry cells for supplying transmitter current. However, this farm line problem will be with us for some time to come and may find a solution before very long.

Now as illustration, an example. Assuming the 150 pair, 75 pair and 25 pair cable in Fig. 1 extending from the office to the uppermost distributing box were of No. 22 gage, then the transmission loss for a subscriber's line connected to the 25-pair distributing box would be 0.79 db, if the distance from the office were one-half mile and the mutual capacity of the cable 0.083 mf per mile. This remains by far inside the limit of 4 db; even No. 24 gage cable would not reach the permissible loss limit.

Suppose a farm line were connected to this same distributing box, the farm line being of No. 12 iron wire and 10 miles long. The loss in the No. 12 iron wire would be $10 \times 0.3 = 3$ db. Adding to this the 0.79 db in the cable would bring the total transmission loss to 3.79 db, which is just inside the limit.

The case cited above starts out with an exceedingly short cable. It indicates therefore, that the limiting loop of subscriber's lines can be extended considerably.

WORLD'S LARGEST LOUD SPEAKER TO BE AT WORLD'S FAIR

The largest loud speaker system in the world, adequately covering the two and one-half miles of grounds, has been signed for Chicago's Century of Progress Exposition.

The address system will be arranged so that it will bring to the visitors not only announcements of the management, but broadcasts and pages for important personages on the grounds. Arrangements are also being made to have the system carry musical programs originating within the grounds or re-broadcast from outside stations.

Some idea of the size and power of the system may be obtained from the fact that it will distribute 1,000 watts of undistorted power which will be distributed through 100 electric dynamic speakers.

The giant sound distribution system will include a complete central station located where visitors to the fair can conveniently see it in operation. The central station will be augmented by two pickup stations and one portable remote control station.

The contract for the system has been signed with the Electric Acoustics Products Company, which will install the equipment both for the use of the fair management and as an exhibit of the company.

Wisconsin Telephone Rate Cut

• Wisconsin Commission Reduces Charges 12½%—Forces Company to Revise Accounting. "Reasonable Return" Basis Is Discarded. Clear Statement by "Barron's", Boston, Mass. •

A general reduction of 12½% in the local rates of Wisconsin Telephone Co. in 102 communities in Wisconsin was ordered by State Public Service Commission, effective the first billing after July 31. The company's common stock is 100% owned by the American Telephone & Telegraph Co.

The reduction applies to all classes of exchange service except toll lines. Saving to Wisconsin patrons will total about $1,550,000, with $850,000 in Milwaukee.

Allows 6% on the Common

The order indicates the commission believes it has been conservative and that a further reduction probably will be ordered when the state-wide investigation of rate structure and practices is completed in about a year. The rate, the commission held, was sufficient to assure 6% on the common and a "cushion" of $288,000. "Such a return in an economic crisis we find to be reasonable and liberal," reads the commission's statement.

Evidence so far submitted in the investigation indicates the commission found the company had made excessive charges for maintenance and depreciation. The commission restored maintenance to the 1928 level, reduced the average depreciation rate sharply, and made other adjustments in operating expenses which resulted in a total reduction of $1,480,656 below the 1931 cost. This increased the net-operating income of exchange business from $2,331,571, as was shown by the company, to $3,812,227.

The commission then listed the company's obligations, including common and preferred stock, advances by American Telephone & Telegraph Co., funded debt, and notes given to create a pension fund, and found that revenue necesary to cover interest and preferred stock dividends and leave enough to pay 6% on all outstanding common was $2,971,894.

Holds Value of Telephone Service to User Has Fallen

The Wisconsin Public Service Commission ruled, among other things, that because of the decrease in the average family income due to the depression, the value of telephone service has fallen and, citing numerous court decisions, added:

"While the tendency of the courts in recent years has been to give primary consideration to the cost of operation and return upon value, it must not be forgotten that it is still the law that rates, regardless of their effect upon the financial condition of the country, cannot exceed what the services are reasonably worth."

The investigation surpasses anything heretofore undertaken in telephone regulation. The commission, under a law permitting assessment of the costs of investigation to the utility investigated, has assembled a remarkable personnel of experts from all over the country.

Shifts Charges to Toll System

The commission's order indicates clearly that the investigation believe the Bell System's long-distance business has been somewhat of a parasite on the Wisconsin exchange system. The commissioners hold that the toll system must stand on its own feet as though owned and operated by a distinct corporation.

It therefore shifted to the toll system $311,000 of operating expenses which the company had charged to the exchange system, made the toll system responsible for a pro rata share of general property and equipment at the Milwaukee headquarters, which the company carried wholly as exchange property, and ruled that the toll business must carry its full share of the company's interest and dividend requirements.

"Reasonable Return" Basis Ended

The commission shelved the "reasonable return on fair investment" method of fixing rates. It pointed out that the telephone company's business entailed very little risk in comparison with other businesses, that the company had a monopoly, that it had a remarkable record of sustained earnings over a long period, that the depression had increased the purchasing power of the dividend dollar about 50% and so decreased the average family income in Wisconsin that the value of the telephone service in proportion to rates had fallen greatly.

The commissions order, it is expected, will be resisted in the federal courts.

BUILDING SUBSIDY PROSPERITY PLAN

University, Va.—A plan for restoring prosperity by Federal subsidy of new construction and capital expenditures was proposed before the Virginia Institute of Public Affairs recently by Col. M. C. Rorty, former vice president and chief statistician of the American Telephone and Telegraph Company, who gave string indication it may become an administration relief measure.

Contending stimulating building and other capital expenditures is the only way to break the depression, Rorty proposed to Government out of current revues offer bonuses to individuals and corporations that will start immediate construction programs to relieve unemployment.

A fund of $300,000,000 would show whether the plan will work, he said. The amount needed could be raised by a sales tax on one half of one per cent of the national income, he said.

The speaker indirectly intimated this is one of several measures now being considered by President Hoover, and added his belief that this plan has been pronounced workable by governmental and other experts who have studied it and told hearers that they may soon be called upon to decide whether they will submit to the sales tax for restoration.

ASSOCIATED TELEPHONE UTILITIES CUTS CAPITAL

Stockholders of Associated Telephone Utilities Company have approved reduction of authorized capital stock to 2,300,000 shares from 3,300,000 shares, and authorized common stock to 2,000,000 shares from 3,000,000 shares.

Stockholders also voted to release subscribers to stock of the company on a partial-payment basis from their contracts by authorizing immediate delivery of stock at the contract price in amounts equalling cash paid in and cancellation of the remainder of the obligation.

To eliminate the possibility of future tax liability stockholders authorize the company to divest itself of the power to operate public-utility properties.

$1,775,000 FOR TELEPHONE IMPROVEMENT

The expenditures of $1,775,000 for construction purposes in the upstate area of this state was authorized by the Board of Directors of the New York Telephone company at the regular monthly meeting held June 22, according to an announcement made by J. S. McCulloh, president.

The estimates include provision for repair and replacement of toll pole line construction at several points in western New York. The greater part of the total represents estimated requirements during the third quarter of the year for minor plant additions and replacements and the installation of subscribers' equipment.

The Latest Telephone Apparatus Patents

A Description of Outstanding Patented Inventions on Telephone, Amplifying and Acoustics as They are Granted by the United States Patent Office. This information Will be Found a Handy Reference for Inventors, Engineers and Plant Men in Establishing Dates of Record, Etc.

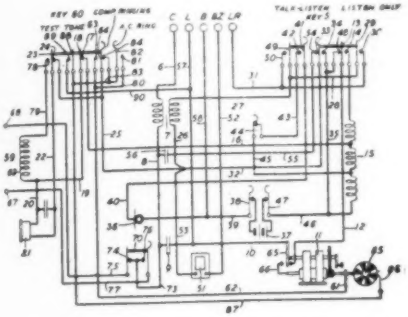
Conducted by

BEN. J. CHROMY

Patent Attorney

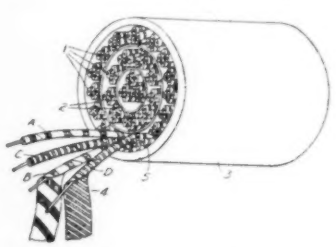
Washington, D. C.

1,860,455. LINEMAN'S TEST SET. Eginhard Dietze, Westfield, N. J., assignor to American Telephone and Telegraph Company, a Corporation of New York. Filed Sept. 2, 1931. Serial No. 560,853. 9 Claims. (Cl. 179—175.1.)



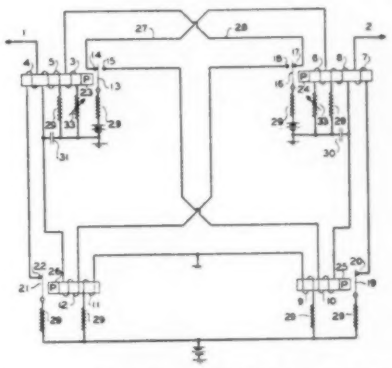
1. A lineman's telephone set to be connected to lines in a signalling system in which carrier currents are employed in the transmission of signals, said telephone set including a filter to prevent cross-talk between the carrier channels and interference with the carrier conversation by the telephone set.

1,856,676. TELEPHONE CABLE. William Kirby Weston, Sanderstead, Surrey, England, assignor to Western Electric Company, Incorporated, New York, N. Y., a Corporation of New York. Filed Feb. 9, 1929. Serial No. 338,709, and in Great Britain Feb. 14, 1928. 6 Claims. Cl. 173—264.)



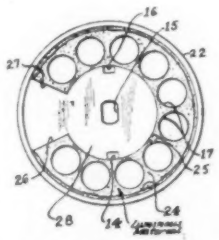
1. A telephone cable having a plurality of conductors, paper insulation on said conductors, a coloring substance applied to said paper insulation in such an amount as to equalize the capacities between conductors and in such formation as to serve as distinguishing marks on said conductors.

1,868,706. SINGLE LINE REPEATER. Frederick G. Hallden, Jamaica, N. Y., assignor to International Communications Laboratories, Inc., New York., N. Y., a Corporation of New York. Filed June 21, 1930. Serial No. 462,793. 23 Claims. (Cl. 178—71.)



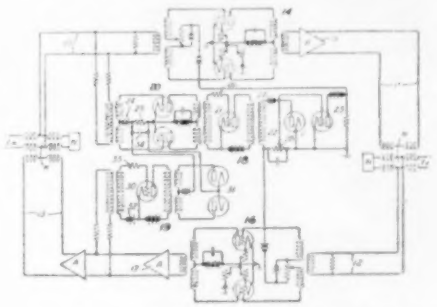
1. In a single line telegraph repeater, polarized input relays having line windings and biasing windings, a retransmitting relay operable from each input relay, and means operable from one of said input relays to shift from one winding to another the magnetizing forces in the other input relay without moving the armature thereof.

1,866,157. LUMINOUS DEVICE FOR DIAL TELEPHONES. Clinton E. Ford, Winsted, Conn. Filed May. 9, 1931. Serial No. 536,134. 2 Claims. (Cl. 240—2.25.)



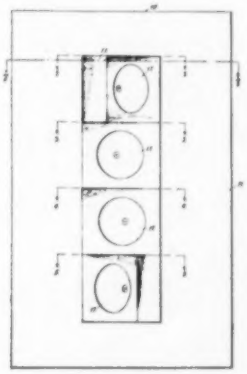
1. In a dial telephone, a dial, an apertured finger wheel spaced from said dial and mounted to rotate with respect thereto, said finger wheel having its surface next to said dial coated with self-luminous material for rendering said dial visible in darkness.

1,866,592. VOICE OPERATED REPEATER CIRCUIT. Byron B. Bjornson, New York, N. Y., assignor to Bell Telephone Laboratories, Incorporated, New York, N. Y., a Corporation of New York. Filed June 7, 1930. Serial No. 459, 652. 4 Claims. (Cl. 179—170.)



1. In a voice operated circuit, a circuit for producing a direct current voltage from speech energy, comprising a rectifier preceded by an amplifier, and means to make the operation of said rectifier and amplifier marginal, said amplifier reaching substantial saturation at the input level corresponding to initial operation of said rectifier.

1,866,831. AUDITORIUM LOUD SPEAKER. Irving Wolff, New York, Russell P. May, Bronx, and Abraham Ringel, Brooklyn, N. Y., assignors to Radio Corporation of America, a Corporation of Delaware. Filed Aug. 3, 1928. Serial No. 297,218. 20 Claims. (Cl. 181—31.)



1. A loudspeaker comprising a supporting member, and a plurality of sound radiating elements in vertical alignment carried by said member said sound radiating elements being arranged to radiate sound waves directly to the open air in directions substantially perpendicular to the line of vertical alignment and at angles to each other.

A Timely Tip to Practical Farmers

Well-timed, specific advice is always more interesting, more likely to be acted upon, than vague generalities. And on that basis, the telephone is being advertised to farmers in the publications that they read.

The advertisement on the opposite page, for example, appears in farm papers in July and August when grain is ready for threshing. It suggests a *definite* use of the telephone—emphasizing its convenience—the saving of time and money it makes possible. Other advertisements in the series offer other such hints which should be of interest to practical farmers.

A large part of this advertising's appeal is the fact that it's written in farm language by men who have actually been farmers themselves. It should stimulate rural telephone traffic to the mutual benefit of all telephone companies.

"We start threshing tomorrow"

THE MACHINE was all set and ready for tomorrow's run. And now the farmer had only to round up the threshing gang previously arranged for. He spent a short half-hour at the telephone after supper, calling this neighbor and that one. Some he asked to bring only a pitch fork. Others were asked to bring a rack.

Bright and early tomorrow they will be coming — across the fields — around the roads. A little later this farm will be alive with the excitement of a threshing gang. And the farmer made up this party over the telephone.

Over the telephone — that is the way a great deal of farm business is transacted. Miles are covered in a few minutes. The time saved is money made. Most important of all, probably, are the telephone messages which inform the farmer about prices for livestock and produce. Every day the telephone is indispensable to the farm. The cost is small for value received.

A BELL SYSTEM ADVERTISEMENT

An Advertisement of the American Telephone and Telegraph Company

News From the Field

The Iowa Union Telephone company of Forest City, Iowa has recently installed a new combination long distance and local switch-board. This was made necessary by the increasing toll and local business of that town.

Many newspapers throughout the state of Wisconsin are broadcasting that the cost of telephone service in that state has been decreased 12½c by the state commission. The fact is that though the service remains the same, the charge to the user has been reduced the above amount.

The increased postage put into effect by the government August 6 costs the American Telephone and Telegraph $21,000 extra to mail out dividend checks to their subscribers.

The Interstate Commerce Commission approval has been requested of the acquisition by the Ohio Bell Telephone Company of the properties of the Beaver Telephone Company. The latter company operates a telephone service at North Lima and the Youngstown, Ohio, vicinity.

A telephone subscriber at Davenport, Iowa, has planned a unique method for keeping trace of his dog by having his telephone number on the dog's collar. He states this has resulted in the dog being returned to him several times this year.

The Chesapeake and Potomac Telephone company of West Virginia has been ordered to reduce its rates on handsets by the West Virginia Public Service Commission. The rental for the French phones is an extra charge of 50 cents per month, and the commission orders a reduction of 50 per cent.

The Illinois Bell Telephone Company is making a fight to retain the charges of 25 cents per month for the cradle type of telephones. In presenting their arguments they submitted exhibits showing the cradle phone costs the company $5.08 more than the old style desk set and $3.03 more per year for maintenance.

The Indiana Bell Telephone Company has recently completed installation of a new system at Boonville, Indiana. This new system, installed at a cost of $75,000, includes a new telephone building, a modern switchboard, new instruments and under ground cables in the business section of the city.

The E. M. Thomkins Telephone Company of Dunn Center, North Dakota, recently took over the property of the Dunn County Telephone Company. Mr. E. M. Tomkins will be manager of the properties; he will reside in Halliday.

Farmville, Virginia, has begun improvements at the telephone exchange and is revamping the service line throughout the town. Cables will be used to replace the open wires, which will remove many of the poles. The new cable will have a capacity double that of the present, enabling the company to provide for anticipated growth.

The Navajo-Apache Telephone System of Ajo, Arizona, is planning to make improvements in its local exchange.

The Geneseo Cooperative Telephone Company is laying underground cable in that Illinois town, and therefore improving its service.

The Washington-Kansas exchange of the United Telephone Company was nearly destroyed recently when a tornado struck Concordia. Buildings within ten feet of the exchange were destroyed and a number of lives were lost.

Fire in the telephone exchange at Celina, Texas, recently did considerable damage to the properties of that concern. It was necessary to install a new switchboard to take care of the business.

The Mutual Consolidated Telephone Company of Cedar Vale, Kansas, is installing a new switchboard in the exchange of that company. It is understood that bids are being secured for this equipment.

New copper wire circuits are under construction between Denver and Salt Lake City by the Rocky Mountain Telephone Company. The new wire will be strung by way of Steamboat Springs, Colorado. The project will necessitate five carloads of poles.

San Antonio, Texas, is still wrestling with a rate case which has been in the federal courts for eight years. The telephone company won its case, the city appealed and the phone company secured an injunction to prevent the city from enforcing a reduction while the case was on appeal. The city is now trying to have the injunction dissolved.

The Bartley Mutual telephone company of Bartley, Nebraska, has been given authority by the state commission to reduce its net rate 25 cents per month for six months.

The Western Telephone Corporation of Nebraska has been granted permission to waive the collection of service connection charges to all patrons of its exchanges during August and September.

The Iowa-Illinois Telephone company is placing underground cable at Columbue Junction, Iowa. This gives the exchange double capacity and prepares the way for future growth.

The Iowa Union Telephone Company of Emmetsburg, Iowa has purchased a two-position Stromberg-Carlson toll switchboard to add to its present toll board at Forest City, Iowa.

TAX ASSESSMENT ON TELEPHONE COMPANY INCREASED

Aurora, Ind.—Word has been received from the State Board of Tax Commissioners that the assessment for The Ohio River Telephone Company for the year 1932 has been fixed at $65430. This is an increase of over $10,000 over the assessment of $54720 for 1931.

In commenting on the increased assessment, R. V. Achatz, of Aurora, who has been president of the company since the death of C. R. Green, stated that he was unable to explain the increase in assessment, since neither the plant nor the business has been increased during the past year. In fact, he stated that there had been a considerable decrease in revenue, due to loss of a government contract for special service to Dam 39, and a general falling off of the long distance business.

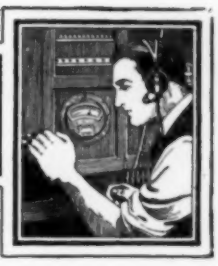
According to Mr. Achatz, it will be difficult for The Ohio Telephone Company to meet the increase of several hundred dollars in its tax bill, particularly on account of the low rates and slender margin of profit for several years past. Mr. Achatz states that a petition for a re-hearing will be made.

TELEPHONE MAN CONDUCTS DRIVE

The "war against depression" launched in St. Louis, Mo., by the American Legion is being carried on under the direction of Col. H. D. McBride, secretary of the Southwestern Bell Telephone company, who has been appointed general chairman for the St. Louis district.

THE TECHNICAL CLEARING HOUSE

B. C. BURDEN, Editor



Electrical Reference Books

Q.—Please advise what books you would recommend for use both as an electrical text book and as a reference source.

A.—For those who desire a set of books for home study purposes and also useful in looking up practical applications of electrical theory I believe **Audel's New Electric Library** to

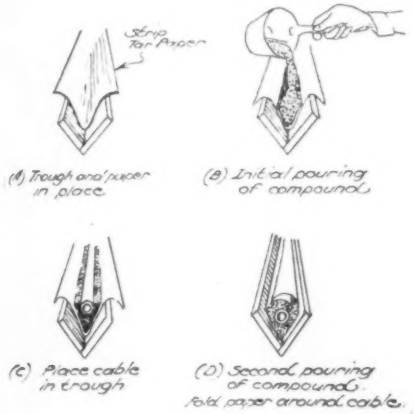

Strip for Paper
(A) Trough and paper in place.
(B) Initial pouring of compound.
(C) Place cable in trough
(D) Second pouring of compound. Fold paper around cable.

Fig. 1. Method of placing asphalt on cable (trough method).

be the best books available for this purpose. These books which have just recently been published consist of ten volumes and sell for $15.00 for the set. They can be purchased by writing direct to Telephone Engineer, Chicago. They are the only set of books of their type that contain practical information on such subjects as X-rays, sound pictures, telephone systems, arc welding, and other similar subjects not usually covered in books of the home study type.

Permalloy

Q.—What characteristic of permalloy make it particularly well suited for use in communication equipment?

A.—Permalloy is a nickel iron alloy having a very high permeability. Its extremely low hysteresis loss and the fact that a high flux may be produced with a small magnetizing force make it ideally suited for use in telephone apparatus.

Fire Hazard in Central Offices

Q.—Should the small exchange have fire fighting equipment available for use in case of a central office fire, or merely rely on the public fire fighting facilities?

A.—Because of the serious damage to service that might result from even a minor fire, it is highly desirable that every central office be equipped with some means of extinguishing flames. The most modern type of extinguisher for use around mainframes and switchboards is the gas type. With this type of extinguisher the fire is quickly smothered out, without damage to insulation that would result were water used. The larger exchanges make use of a neat rubberized tarpaulin folded neatly and placed on top of the switchboard in case of a building fire of such intensity as to make it necessary for the operators to leave their posts, the tarpaulin would be quickly pulled down over the board so as to protect it from water damage. A switchboard saturated with water would be almost as useless as one gutted by fire.

Corrosion of Buried Cable Sheath

Q.—How can a buried cable sheath become pitted with holes if buried in a locality where there is no direct current flowing through the earth to cause electrolysis to take place?

A.—A buried cable sheath may become quite badly pitted even though there is no stray direct current entering and leaving the cable sheath. This is due to what is known as soil corrosion, and results from the character of the soil surrounding the cable such that a galvanic battery is formed by the sheath and soil. The current flowing in this galvanic cell causes pitting of the sheath at the point where it leaves the sheath to enter the soil. Soil corrosion is particularly bad where the cable is located in cinder fills, back of drug stores or restaurants where ice cream freezers are dumped, and especially under manure piles or near stables.

Common Battery Operation Without Relays

J.—Is it possible to operate a common battery exchange without line relays, i. e., have the line lamp connected directly in series with the central office battery and the subscribers loop?

A.—Until recently this plan has not been feasible except in connection with P. B. X. boards where the subscribers loops were all fairly short and in the same building. However, there has recently been announced by one of the large manufacturers a new type of board which will operate without line relays. It is intended for use in the smaller communities where the maximum loop does not exceed 800 ohms resistance. The new board is made possible by an improved type of lamp utilizing a tungsten filament. This lamp gives a fairly brilliant and uniform illumination regardless of the variation in loop resistance provided that it does not exceed 800 ohms. The advantage of this arrangement is the first saving in equipment cost as well as the reduced maintenance expenses as the result of not having line relays to routine.

Cable Trouble

Q.—In locating faults in aerial cable plant is it considered good practice to make "test cuts" in order to determine what section of cable the fault is in?

A.—It is decidedly not good practice to make test cuts to locate cable trouble in aerial cable plant as any fault of low enough resistance to cause trouble can be easily and quickly located by means of Wheatstone Bridge measurements using either the Varley or Murray loop methods. The argument is often advanced by cable splicers in defense of a test cut, that all of the pairs in a cable are wet and that no good wire exists which can be used for making a Varley or Murray test. Where this is the case it is usually possible to string a good

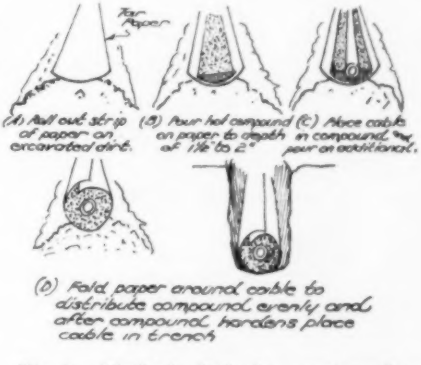

Strip for Paper
(A) Pull out strip of paper on excavated dirt.
(B) Pour hot compound on paper to depth of 1½" to 2"
(C) Place cable in compound, pour on additional.
(D) Fold paper around cable to distribute compound evenly and after compound hardens place cable in trench

Fig. 2. Method of placing compound on cable without trench.

wire across from some nearby cable using either P. O. D. or a small insulated wire temporarily tacked up on the poles with small staples. There are few cases where more than a block or so of "string by" will be needed.

For reasons not apparent to the editor many practical telephone men seem to think that a Wheatstone Bridge is too complicated for use in the small exchange. As a matter of fact anyone

that can count sheep can learn to operate a bridge with a few days practice.

Buried Cable Construction

Q.—Please explain the methods ordinarily used in applying compound to lead cable preparatory to burying it directly in the earth.

A.—There are two methods used in compounding the cable sheath preparatory to placing it in the trench.

One method makes use of sections of wooden trough usually ten feet in length as illustrated in Figure 1. Five to ten sections are usually provided and are placed end to end on trestles placed in the trench. A strip of tar paper from 6 to 16 inches in width is rolled out along the bottom of the trough. The cable is pulled off the reel and layed out along the trench and through any intervening conduit on cross streets. Heated compound is next poured on the paper in the trough to a depth of approximately ½ inch. After the compound has cooled slightly the cable is layed in and additional compound poured over it. A man follows up and folds the tar paper around the cable, taking care to distribute the compound evenly over the sheath. A layer of compound from ¼ to ¾ inch is desirable. By the time the operation is completed on a 100 foot section the compound will have cooled sufficiently to permit romoving the trough and trestles at the starting end and the cable may then be placed on the bottom of the trench. This is of course followed by back filling and tamping.

It is quite essential for best results that the cable sheath be cleaned with gasoline before compounding in order to remove grease left from cable manufacturing operations which would prevent the compound from adhering firmly to the sheath.

The other method of applying compound differs from the first primarily in that the paper is rolled out along the top of the excavated dirt instead of using troughs for this purpose. The chief disadvantage with this method is the difficulty of getting a uniform distribution of the compound. Figures 1 and 2 illustrate the various steps in each method.

PURCHASES STROMBERG-CARLSON SWITCHBOARD

The Blue Earth Valley Telephone company, Blue Earth, Minn., has just ordered three sections of the No. 3 Stromberg-Carlson unit type switchboard for installation at Blue Earth. The switchboard will consist of 680 central energy and 65 toll and rural lines, and will be complete with terminal, power and machine equipment.

Sulphur, Oklahoma, to Have New Telephone Exchange

By P. WINEMILLER, Sales Engineer
Stromberg-Carlson Telephone Mfg. Co.

Combining utility and beauty, the Sulphur Telephone Company of Sulphur, Oklahoma, has just erected one of the most impressive buildings to house its new telephone equipment, which is to be installed in the near future.

The attractive new structure adds another fine building to the business district of Sulphur and is a testimony of the aggressiveness and spirit of the management of the Sulphur Telephone Company.

New telephone building erected by Sulphur Telephone Company, Sulphur, Okla., and F. Crawford, manager.

The building is one story with a basement, the story height being exceedingly high to provide ample light and ventilation and proper clearance for the new telephone equipment.

The design is modernistic and rates in architectural beauty with any one-story building that the writer has had the opportunity to see.

It is finished in ornamental brick of special manufacture. Four pilasters on the front of the building give it an appearance of individuality and of unusual beauty. The pilasters are capped at the top with attractive stone ornamentation of modern design. A wide tile walk leads to the stone landing of the main office entrance.

On the left of the building there is a wide tile walk to a side entrance which leads direct to the operators' rest room. This entrance is bordered on either side by two pilasters of the same design as those on the front of the building.

The entire structure is of semi-fireproof construction, the floors, columns, etc., being of reinforced concrete and window casings of steel.

Leading from the main entrance is a large and attractive commercial office, with private offices for officials leading from it. Immediately beyond the office there is the operating and terminal room which will house the new switchboard, main frame and power equipment. The room is finished in celotex, assuring proper acoustics for an operating room.

To the left of the operating room, the operators have a well appointed and comfortable rest room, the entrance to which is gained by a side entrance.

Space for batteries is provided in the rear of the building.

The new switchboard which will be installed in this new building is a four position Central Energy Stromberg-Carlson unit type. It will have an ultimate capacity of 1600 local lines and will be equipped with 600 local lines, 20 rural lines and 10 toll lines. All these lines, excepting the toll lines, will be multiplied throughout the board. Each position will be equipped with universal cord circuits, so that any call can be answered and completed at any one position without the use of order wires and trunking circuits.

The main distributing frame, an A-type, will be equipped with Cook Protectors and will terminate 1,200 cable pairs from the local distribution plant.

Fifty Ways to Sell a Telephone

In This Article the Author Shows How the Prospects May be Approached From Many Angles, and Where the Salesman Can Justify Himself Because of the Fact that the Prospects Need the Service and Do Not Know It.

By
OWEN G. JARBOE
General Traffic Superintendent
Central and Eastern Operating Companies of the Associated Telephone Utilities Co.

To paraphrase the old political slogan; now is the time for all good men to come to the aid of their company. Telephone companies have suffered losses in stations, and further losses in telephones are being experienced each month. While there are some bright spots indicating better times in the offing, still it is expected that considerable time will elapse before we can expect to return to normalcy.

If you owned a telephone company, what would you do under similar conditions? Would you continue to go about your daily routine, doing merely that which was required of you, or would you get out and rustle up some new business to take the place of that which had been lost? The answer is already framed in your mind as you read this sentence; if it was your own business you most certainly would get out and do your level best to help improve it. Now here is the point that you may not have considered, it IS your business! You have your future invested in it, your every effort—every day you work—is an investment of time, a most valuable asset. Let us say to ourselves then, "This is MY company! I am going to do everything I can to help make it a success.

The participation by employees in selling telephones as a part of the regular job was, not so long ago, merely an undeveloped idea. Quite obviously the thing that is most needed now, is new business—more telephones, and it becomes imperative that sales efforts be put forth at every opportunity that presents itself. I believe that all of us possess the necessary information and ability to make an analysis of the customer's requirements and to intelligently suggest the class of service that is most adequate.

Successful selling is dependent largely upon ability to recognize sales opportunities. The field of sales opportunities is fertile, but it is left to us to cultivate it. Every contact we make in our daily routine of life offers an opportunity to use our "Sales Appeal." You may say, "I am not a salesman. I don't know how to sell." While it may be true that some are better salesmen than others, everyone can be a salesman if he wants to. Salesmanship is simply the power of persuasion.

A great deal could be said of the value of telephone service, and how easy it is to sell, but it has been my experience that the thing that helps most is knowing where to sell and what to sell. Let us therefore, get back to the subject of this article. Following are fifty ways to sell a telephone. All of them have been tried out and have proven successful. Unduobtedly you will develop other effective sales ideas.

The term "main line station," as used here, is to distinguish between a telephone connected to a main line, and an extension, and does not mean an individual line.

1. Sell a main line station to every residence, apartment, shop, office or store that does not now have a telephone. Every place that does not now have a telephone is a prospect for one. Stress the savings in time and the convenience in having a telephone, and bring out the factor of safety in the protection of life and property by the prevention of fires and burglaries, and the accessibility of a doctor in case of sickness or accident.

2. Farmers, truck gardeners and the sellers of poultry and eggs have found that their produce can be sold over the telephone before they leave their farm for town. Customers can be called and their orders taken, thus saving a great amount of time that would otherwise be consumed in house to house peddling. Sell these people a main line telephone, possibly with an extension to a barn or other out-building. Stress the idea that if they leave their telephone number with their customers they can receive orders from them.

3. Painters, carpenters, and other craftsmen who depend upon a house sign or the kindness of friends to get them business, can have a telephone installed and advertise their number through the classified directory, in this way getting more business. Sell them a main line station with an extension if it seems appropriate.

4. Unemployed workmen who have a truck that could be used for draying or rented by the day will find that a telephone with an appropriate classified ad will get them more business. Sell a main line station and an extension if possible.

5. Women who work out by the day doing housework, sewing or washing, or who take care of children or take orders for baking, have need of a telephone in order to make it easy for their customers to get in touch with them. Sell a main line station.

6. Men who work in mines or shops, or are subject to call by the railroad, the employment relief agencies, or the city, should by all means have a telephone. Sell a main line station.

7. Rural schools as well as city schools require a telephone for the protection of the children. A recent disaster in a Colorado town where a number of school children were frozen to death in a blizzard because there was no telephone in the school has brought this forcibly to the attention of the American public. The amount it would be necessary to add to the tax rate of a school district would be so small as to be negligible and the advantages may be the saving of one or many lives of the school children. See the chairman of each school district, or talk to the school board about it. Sell a main line station.

8. Every new family that moves into the neighborhood needs a telephone in order to maintain contact with old friends and to make new ones. Call on them, introduce yourself, and take their orders for telephones to be connected at once. Frequently in moving, even though it is their intention to have a telephone at the new location, a family may delay a month or more in attending to this important matter. If, through your efforts, a telephone can be placed one month earlier than it would otherwise be installed, you have gained that month's rental for the company.

9. The small children in a home provide an especially good argument for you to sell a telephone to the householder. The probability of accident, fire, or illness in such cases is greatly increased and the protection of the lives of the children demands the safe-

ty of the telephone. Sell a main line station and an extension if possible.

10. Due to the large amount of unemployment at present many people have placed applications for work with various business firms and employment agencies. If they do not have a telephone it is not likely that they will receive the same amount of consideration as other applicants who do have one. If a position can be secured sooner by having a telephone, the cost of one will be piad for many times over and the all-important problem of finding work will be more easily solved.

11. Just prior to the time your directory goes to press, canvas all of your prospects for telephone sales and tell them if their order is placed at once their names will appear in the new directory. This will be an incentive for them to give you their order without further delay.

12. Due to the keen competition now existing in business, it has become necessary for progressive business firms to go after the business. The telephone is being used more generally for this purpose. Suggest to business men that they call their customers to tell them of the merchandise they have to offer and to notify their customers of bargain days. This sort of advertising has been found to be most profitable by many merchants. Use this argument to sell additional main line stations or additional trunks to P. B. X. boards in business firms.

13. Many people are trying to augment the family's income by renting one or more rooms or by taking in boarders. Usually a prospective roomer will not go to an address to see a room without first calling over the telephone to see if it is still available. Use this argument to sell a main line station to people who have rooms for rent.

14. Prospective tenants will not rent rooms without convenient telephone service. This is an additional reason why people with rooms for rent should have a telephone with one or more extensions.

15. Tenants in small apartments or rooms, or permanent guests in hotels, are good prospects for telephone service. A telephone of their own will give them the privacy that they desire in their telephone conversations and their own name will be listed in the telephone directory which assures them of getting all of their incoming calls.

16. Wedding announcements in the newspapers are indications that another family will soon need telephone service. Make it a point to call on these people either personally or by telephone and take their order for a main line station, and if possible, an extension also.

17. Read the building permits in your local newspapers and keep your eyes open for new construction going on in your neighborhood. Residences and business buildings in the process of construction are indications that someone is going to need telephone service. In the case of an office building or apartment, secure the names of the tenants from the building manager and solicit them for service. Find out, if possible, who is to occupy a house under construction and see them before the building is completed so that wiring can be included in the building plans.

18. Lodges, clubs and churches should have telephone service for the convenience of their members. Sell a main line station or a coin box, and in all cases attempt to sell an extension also, so that the caretaker or attendant can answer incoming calls. In the case of country clubs, an extension should be placed in the caretaker's quarters or in the kitchen, or both.

19. At present there are beauty shops operated in conjunction with many barber shops. Sell a main line station or an extension to the beauty shop in order that they may receive all the business possible and so that it will not be necessary to keep their customers waiting while answering the telephone in some inconvenient location.

20. Have the Chief Operator keep a record of the calls to people not having a telephone, and make use of this information to sell main line stations to business places and residences. A list of these calls is one of the most convincing arguments you can present to a prospect. This will show him that he is losing a certain number of business or social contacts every day. Don't be discouraged if you do not sell him the first time, go back again next month with additional information.

21. Make use of the information furnished by the Chief Operator, on lines reported frequently busy, to sell additional trunk lines or main line stations to business places. When it is explained to a customer that his telephone door has been closed to a certain number of people each day, you will find that this is a very convincing argument for additional service. A complaint of not receiving calls will likewise indicate that additional service is needed. Observation on the premises may help you to clinch this argument.

22. Out-door telephones are used by many taxi companies, lumber yards, and other businesses requiring their employees to be out of doors. Find out if there are not some such businesses in your town that could make use of this equipment. Sell them main line stations and as many extensions as are required.

23. Many banks have had main line stations installed in the vault in armored conduits as a protection against bank robberies where employees of a bank have been locked in a vault. If your banks do not have this service explain that it is a necessary precaution for the safety of life and property.

24. Sell coin box telephones to drug stores, barber shops, hotels and clubs and pool rooms to displace flat rate telephones that are to be moved to private locations. It will be necessary to receive the approval of the commercial representative before this service can be sold. Explain to the proprietor that the installation of a coin box will eliminate his worries over toll calls charged to his telephone by customers, and will leave his line available for incoming as well as outgoing personal calls of his own.

25. Oil and gasoline stations are better patronized if they provide telephone service and advertise this fact. Sell them a coin box telephone if the amount of business warrants it, and if not, a main line station.

26. A store having separate grocery and meat departments should have a main line station accessible to both. If it is not possible to sell an additional main line station, sell an extension.

27. Cripples, invalids and recluses should have a telephone for the sake of both safety and convenience. Sell a main line station, or if they already have a telephone, sell an extension to be placed at a convenient location.

28. Real estate offices, insurance offices, and other businesses employing a number of people who have occasion to deal with the public, should have a main line or an extension on the desk of each. If there are a number of people employed, sell a P. B. X. or intercommunicating set.

29. Every hotel, even in the small town, should have a private branch exchange with an extension to each guest room as well as to the various service departments. This is one of the best conveniences that can be supplied by a hotel to its guests as well as being one of the cheapest. Sell a P. B. X. and extensions.

30. Public schools and state or coun-

EVEREADY LONG LIFE TELEPHONE BATTERIES

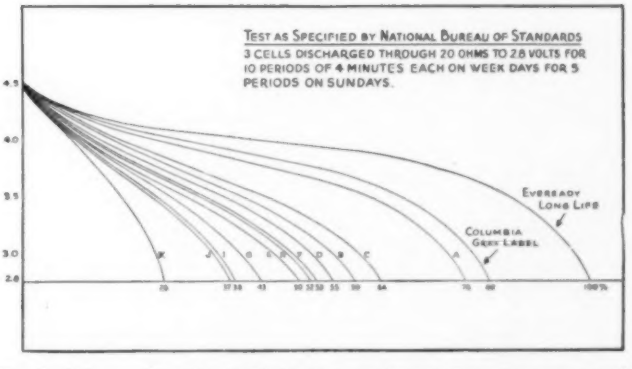
OF HIGH importance to you is the radical reduction in prices announced by National Carbon Co., Inc., on Eveready Long Life and Columbia Gray Label Telephone Batteries. In addition, the new metal-seal top (developed and patented by us) gives all-armored construction, insures against moisture losses occurring in wax-seal top batteries, and definitely guarantees a longer and more satisfactory life. This big feature and the new low price offers you

greatly reduced magneto telephone operating costs,

better talking qualities, greater subscriber satisfaction — all vital factors these days.

Ever since its introduction Eveready Long Life has been the longest-lived telephone battery on the market. Now, with the metal-top construction, its service capacity is still further increased. This increased service plus new low price results not only in a greatly lowered operating cost per day but also reduces the highly important item of labor cost in renewals due to less frequent replacement.

Write your distributor for the new price schedule; order a substantial quantity of these super-service dry batteries — then note how they'll push your magneto telephone operating costs downward.


TEST AS SPECIFIED BY NATIONAL BUREAU OF STANDARDS
3 CELLS DISCHARGED THROUGH 20 OHMS TO 2.8 VOLTS FOR 10 PERIODS OF 4 MINUTES EACH ON WEEK DAYS FOR 5 PERIODS ON SUNDAYS.
4.5
4.0
3.5
3.0
2.0
EVEREADY LONG LIFE
COLUMBIA GRAY LABEL
K J I H G F E D B C A
70
100%

Day's life on Standard Light Intermittent Test is expressed in percentages based on Eveready Long Life as 100%. The Columbia Gray Label shows 82% service, but also carries a lower price.

NATIONAL CARBON COMPANY, INC.

General Offices: **New York, N. Y.**

Branches: **Chicago New York San Francisco**

Unit of Union Carbide UCC *and Carbon Corporation*

EVEREADY
Dry Batteries

ty institutions should have a private branch exchange with extensions to the various rooms or departments. The convenience and safety of such an arrangement can easily be pointed out. Sell a P. B. X. and as many extensions as are needed.

31. Your personal knowledge of the organization of a firm or an inspection of the premises may indicate that certain P. B. X. extensions are frequently busy. Reports on toll of "Extension busy" will also be an indication that additional extensions are needed. Sell one or more P. B. X. extensions as needed.

32. Every two story residence is a prospect for an extension telephone. Explain the convenience of having the telephone in hall or bedroom upstairs and the safety that such a telephone will provide. Sell an extension telephone to be located in the bedroom or hall.

33. Doctors, undertakers, garage men and others who receive night calls need a bedside extension. Explain the convenience and in addition suggest a hand-set.

34. Women who are alone a great deal at night need a bedside extension for their protection. This is a very convincing argument and you should have little difficulty in making a sale.

35. Sons and daughters of high school age or older like privacy in their conversations with friends. Sell an extension for their rooms.

36. Business men who have a telephone on their own desk should also have an extension on the desk or their secretary and possibly a buzzer signal to be installed by the telephone company.

37. An extension telephone and extension bell or gong are useful in coal yards, lumber yards, garages, and other businesses requiring their employees to be out of doors. Sell an extension gong or bell and extension telephone to be located in a convenient place.

38. Sell a P. B. X. switchboard and out of doors P. B. X. station to police and fire departments for signaling and talking purposes. This equipment may be sold where there is not any existing equipment or to displace existing police or fire call boxes. It is especially suitable in medium sized towns. Additional power relays can be installed at the outside stations to provide a means of signaling either by a gong or light signal from the P. B. X.

39. Sell a private intercommunicating magneto telephone to farmers to be installed between the house and barn or other out-building. Farms where the house and barn are separated by unusual distances are especially good prospects for this type of service.

40. Sell an extension telephone to farmers to be located in the barn or other out-building.

41. There are many cases where a business man occupies rented desk space in another office. Sell him a joint users rate, extra listing, and extension telephone if you are not successful in selling him a main line station.

42. Repairmen sent to remove vacant premise telephones should attempt to sell a main line station and to collect the service connection charge by explaining to the prospect that if the station is once removed, a greater charge will be made to have a telephone reinstalled. He can at the same time suggest extension telephones and extra listings if this seems appropriate.

43. Repairmen, at the time of disconnecting a seasonal subscriber telephone, should attempt to get an order for the reconnection of the telephone to be made at a specified time the following season. Managers should write to regular seasonal residents prior to the start of the season, and attempt to get an order for the connection of the telephone at a specified time. It can be explained that if the order is placed early enough the same line number and ring can be assigned.

44. In residences where the kitchen is two or three rooms removed from the location of the telephone, sell an extension to be located in the kitchen.

45. Where the telephone is in the hall or living room, there is no opportunity for private conversations in cases where there are guests or where for any other reason, a private conversation is desired. Sell an extension telephone to be located in another room.

46. Obtain regularly, from the Chamber of Commerce, or other civic organization, a list of the new arrivals in your city. Send them a letter or folder welcoming them to the city and telling them that you are sending, under separate cover, a telephone directory for their convenience. Enclose a business reply card or call in person to take their order for a telephone.

47. There are many men and women conducting small businesses from their homes. These include the sale of hosiery, magazines, cosmetics, insurance and household articles. Everyone engaged in such a business is an especially good prospect for telephone service, as it provides a means of receiving and soliciting sales orders. Sell a main line station.

48. Where the radio and telephone are close together, it is frequently found that the radio interferes with telephone conversations. To shut off the radio during conversations spoils the program for listeners. An extension out of hearing of the radio is a great convenience in such cases. Sell an extension telephone to be located in another room.

49. Just before the issuance of a new directory, canvas the business classifications to make sure that those depending on seasonal business are adequately provided with telephone service. For the winter directory select firms whose business is especially active in the winter, such as oil burner companies, fuel companies, plumbers, furnace repairmen, and battery and radio dealers. For the summer directory canvas ice cream dealers, ice dealers, soft drink bottling works, cleaners and dyers, etc.

50. Every farm home should have a telephone. There are on every hand arguments to support this assertion. The daily newspapers provide many stories of how life or property was saved at some farm because of a telephone, and conversely, many instances where they were not saved because of the absence of a telephone. Look about you. Talk to your rural customers and pick up local examples of what the telephone has done and is doing for farmers who have them. Get stories of the accomplishments of the rural telephones into your newspapers: the local editor will be glad to print them. Call on the farmers in your territory who do not have telephones and tell them some local stories of the telephone's accomplishment and of the saving of life and property, and show them that for the small cost involved they are taking desperate chances with the lives of their families and the safety of their property. Point out that they are not isolated from the town if they have a telephone and show them that they have the advantage of knowing when and where to sell their produce if they have a telephone to keep them informed of prices.

Notwithstanding the virtual cessation of the growth of the number of telephones by the Southern N. E. Telephone company, 490,000,000 local calls were made in 1931, representing a slight increase over the previous year, and toll calls numbered 25,000,000, a decrease of only two per cent.

FOR OVER 20 YEARS WE HAVE ACTED AS THE OFFICIAL INSURING MEDIUM FOR THE TELEPHONE INDUSTRY

—o—

Broad Form Policy
Specialized Service
Lower Cost

—o—

A postcard will bring you the facts and figures.

UTILITIES INSURANCE COMPANY
A STOCK COMPANY OPERATED BY
LYNTON T. BLOCK & CO.
511 Locust St. St. Louis, Mo.

Specialized Insurance for Telephone Companies

A True Gauge of Toll Traffic

THE Calculagraph is not only a vigilant guardian of toll board revenue, but also an accurate gauge of traffic. The toll tickets recorded by the Calculagraph provide a clerical measurement of toll income down to the last cent, and every penny is always accounted for. Managers also find these records a daily index of their traffic flow—convenient, certain, easy to check up in the brevity of the useful information summed up.

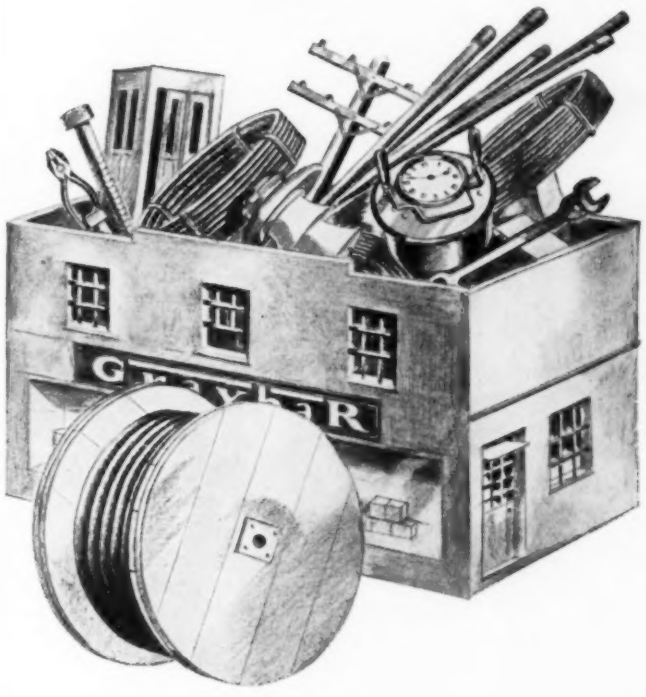
The Calculagraph stamps on the toll ticket the beginning of each call together with the time elapsing during each call, down to the quarter of a minute, for any number of calls—producing a permanent and accurate record of each.

Prices and Information on Request.

THE CALCULAGRAPH COMPANY
50 Church Street Dept. 22 New York City

CALCULAGRAPH
THE ELAPSED TIME RECORDER

for every telephone need



Cable

...and 60,000 other items

WHERE dependability counts—only the highest quality electrical products will do. One such quality product is Western Electric Lead Covered Cable—a cable whose dependability is insured by the most exacting of manufacturing standards.

But that's not all. Out of its roster of 60,000 electrical items, Graybar is prepared to meet *any* need of a telephone industry. And behind *every* Graybar item stands the Graybar reputation for quality that goes back 62 years.

GraybaR

OFFICES IN 76 PRINCIPAL CITIES
EXECUTIVE OFFICES: GRAYBAR BUILDING, NEW YORK, N. Y.

Checking in Poles--Causes and Effect

Here Is Another Very Interesting Article by Messrs. ● C. M. Tilley, Superintendent, and C. H. Lyon, Chemist, of the Texas Creosoting Company, Orange, Texas ●

Checking in poles is a subject that has been given quite a lot of attention in the last year or two by pole users, probably, more than the facts in the case would warrant. Up to that time very little attention was given to checks and it is significant that checking was evidently as prevalent in past years as it is today and that poles which could be styled badly checked are now holding important positions in the line and are apparently functioning as well as poles which are checked very little.

Except in a general way, very little study has been given to checking and our ignorance of the exact causes are both deep and wide. We know, however, that it is the direct result of seasoning and causes from a natural and logical development of this process, and that the seasons and prevailing humidity of the section in which the poles are set are both a considerable factor in the extent and violence of the checking. The position of the pole and the way it is handled has considerable bearing on this phase as it is a matter of observation that poles laying in a stock pile in a horizontal position will check much more than poles set up in the line.

We have a considerable knowledge of the structure and chemical make up of wood and have found out that wood has water in three forms: free water, absorbed water and chemically combined water. The removal of the first form or free water has no effect on the wood structure other than a reduction of its weight. The chemically combined water can only be removed by the complete destruction of the wood itself, but when the absorbed water begins to leave, shrinkage begins and internal stresses are set up that when they overcome the resistance of the wood fibers cause checking.

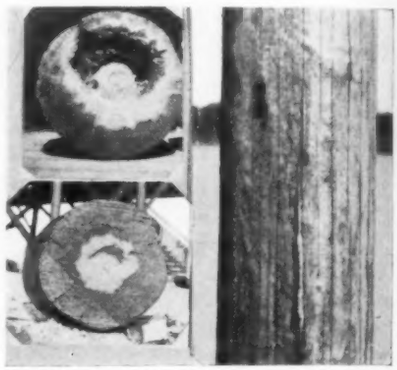
Reading from left to right: Pine pole showing checking in six years—still in service. Old cedar pole showing excessive checking—still in service. Fir pole showing checking in six years—still in service.

It is obvious that moisture will dry from the outside of the stick first and will be replaced by moisture coming to the surface from the interior of the stick. This naturally results in a sharp moisture difference in the pole; the surface is dry enough to shrink while the interior is still too wet. This results in the reduction of the size of the outer layers while the inner layers remain static and too large to be completely surrounded by the dryer outside layers, and as soon as the stresses, caused by this uneven drying, reach the point when they overcome the resistance of the outer layers of the wood, the outer fibers begin to check.

This shrinkage is approximately the same whether the checks are small and numerous or large and few, but they will vary considerably with the different species and with different subdivisions of a single species. For instance, it is a matter of common observation that the firs and cedars check more than the pines while long leaf pine will check more than the short leaf pine.

Wood is gyroscopic and as soon as it has dryed down to a constant moisture content indicated by the prevailing weather conditions, it immediately begins to absorb moisture at the first change of the humidity of the surrounding atmosphere. This causes the checks, which have developed with low moisture conditions, to begin to close until the pole has picked up as much moisture as it will hold with a corresponding closing of the checks. The cycle is repeated with each change in moisture conditions and this "working" of the checks will probably continue indefinitely and has been known to continue as long as observations have been made.

From a treating standpoint checks are not so "hot" with shallow penetrations



Top left: Poorly treated pine pole checked thru treatment into untreated sap. Note how decay stopped at heartwood--12 years in service. Lower left: Well treated pine pole. Checks in this case have not extended through the treated belt. Right: Fungus growth in checks in untreated pine.

and poor distributions in the sapwood, as they are apt to be used by wood destroying organisms as a point of attack. As these organisms attack and break down the sapwood much faster than the heart-wood, where the untreated sapwood is exposed by checking it gives them a beautiful chance to get into their stride and begin their "dirty work". Having established themselves in the sapwood it is only a short step to the eventual attack on the more resistant heartwood but it is easily understood that if the sapwood is well treated and the preservative penetrates to the heart-wood the spores from the wood destroyers do not find a very hearty welcome as the more resistant heartwood is not fertile soil for their planting even if checks extend through the treated sapwood.

From a strength standpoint checking does not seem to be very significant. Objection to large checks is based largely on belief and the strength of a particular pole is dependent on so many factors such as density, moisture content, taper and knots that no exact value can be given to the weakening effect of a check of any given dimension and no

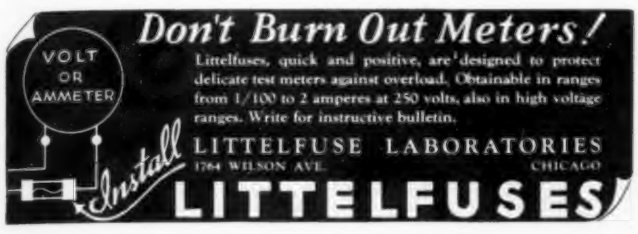
evidence is available among the utilities or pole companies which indicates the necessity of removal of poles from service due to the presence of checks. It has been noted that checks which would be called injurious and cause the rejection of the pole during production when developed in poles after setting, still hold their place in the line without causing undue alarm.

Poles which are steam seasoned will develop checks during treatment as naturally as poles which are air seasoned and the amount of checking in poles seasoned in this manner will to a certain extent, reflect the amount of seasoning which is attained. It has long been a question with some wood preservers whether it were not better to have all of the checking occur during treatment so that all the checks and openings are protected by the preservative, rather than to treat the pole with as little checking as possible and have them develop after erection in the line.

It would seem that pine is from the practical standpoint, the most adaptable timber for treated poles. It has a comparatively deep sapwood belt which, compared to the more refractory timbers used for poles, is easily penetrated. The checking is not excessive and its heartwood is very resisant to decay. This is borne out by the steadily increasing number of treated pine poles used yearly and the latest statistics tell us that out of 4,276,031 poles treated in 1930 that 2,428,173 were Southern Pine.

INSTALLING NEW PHONES AT NEKOOSA

Don Smart of Wisconsin Rapids, Wis., wire chief of the Wood County Telephone company, is busy with a crew of men installing phones for Nekoosa's new automatic switchboard. A number of the phones are in service now and prove to be very satisfactory.


Don't Burn Out Meters!
VOLT OR AMMETER
Littelfuses, quick and positive, are designed to protect delicate test meters against overload. Obtainable in ranges from 1/100 to 2 amperes at 250 volts, also in high voltage ranges. Write for instructive bulletin.
Install
LITTELFUSE LABORATORIES
1764 WILSON AVE. CHICAGO
LITTELFUSES

W. L. Runzel, President, brings to this organization 41 years' experience in the manufacture of this type of telephone equipment

Telephone and Switchboard Cords and Wire

May we quote you on your requirements?

RUNZEL CORD AND WIRE CO.

4727-31 Montrose Ave., Chicago

The Home of the Perfect Cord

Cedar Poles

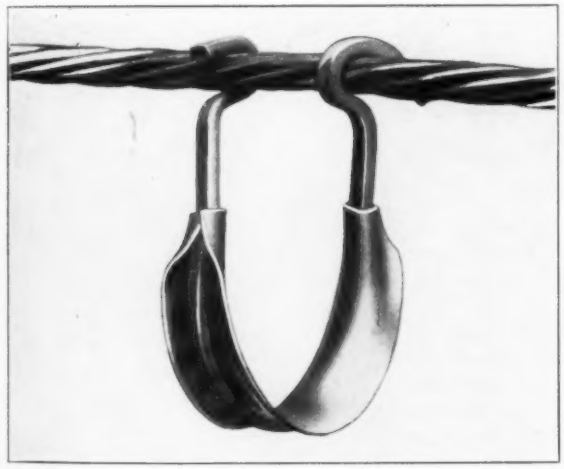
NORTHERN WHITE **WESTERN RED**

PLAIN OR TREATED BUTTS

Prompt Shipment from Minneapolis Yard

T. M. Partridge Lumber Co.

Minneapolis, Minn.



RING CUTTING ELIMINATED

Kearney saddles provide a smooth, nicely rounded bearing surface which protects the cable against ring cutting. Easily installed in the field on nearly all types of standard cable rings. Indispensable on steel bridge installations where vibration is excessive.

JAMES R. KEARNEY CORPORATION

4224-42 CLAYTON AVE. SAINT LOUIS, MISSOURI

KEARNEY

CABLE RING SADDLES

COOK No. 7

LIGHTNING ARRESTER

Insures Against Damage and Interruptions

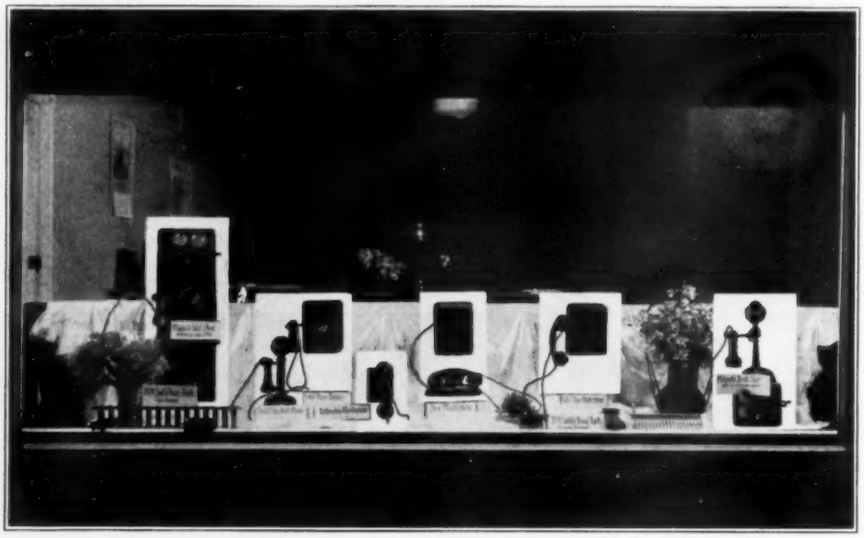
COOK ELECTRIC CO., CHICAGO

Satisfy Subscriber---Let Him Choose Phone

How the Assumption Mutual Telephone Company Solved a Problem of Telephones, and Established Its Goodwill Among Subscribers for Many Years to Come by the Simple Expedient of Letting the Subscriber Choose His Own Type of Telephone From a Complete Display

By
H. A. SEAMARK
Representative
Kellogg Switchboard & Supply Co.

Recently, the Assumption Mutual Telephone Company of Assumption, Illinois, deemed it necessary to replace their magneto plant with complete new central office equipment to better serve their subscribers. To definitely ascertain whether common battery service with the increase in rates that it would necessitate, was wanted in preference to the old magneto service, the company went to each subscriber and obtained the required information. Cards were prepared with spaces for indicating the type of service desired—either magneto at the present rates, or modern common battery service at higher rates. These cards were filled in and signed by each subscriber. Final results showed a 100% choice of common battery service even though it carried with it an increase in cost.



A Telephone Window Display in the Main Offices of the Assumption Mutual Telephone Company, Assumption, Ill. The old obsolete telephones at the end of the display contrast sharply with the more compact, modern sets in between.

After establishing concretely the unanimous preference for the new service, the company was faced with many problems in connection with changing over the system. Among other things was the removal of all the magneto telephones and the installation of common battery sets in their place. Obviously, this meant that a new telephone had to be purchased for every station. The company officials fully realized that the task of choosing correct equipment was not going to be easy. They regarded a proper choice as a matter of the utmost importance inasmuch as every subscriber had to be completely satisfied. One of the directors summed up the situation in these words, "In consideration of the significant influence that modern beauty and appearance has in our every day life, telephones too have been designed along more attractive lines. The telephone company must be sure that their customers obtain these qualities if the subscribers' patronage and good-will are valued."

Consequently, the officials knew that they would have to move cautiously in making their choice. They had planned to use Kellogg instruments, but the exact type of telephone had not been decided upon. They realized that while a desk stand would please some people, others would prefer a masterphone desk set or possibly a wall masterphone. Finally a plan was prepared whereby every subscriber could choose his or her own type of instrument and as a result everyone would be well pleased.

The company obtained a number of telephones from the Kellogg Switchboard and Supply Company including the Masterphone desk set, the standard desk stand, the Masterphone wall set, standard wall set, and Masterphone extension wall set. Each type of instrument was hooked up complete and placed on display in the main office of the company. On each display a card was mounted giving details and the rates for that particular set for both business and residential use.

Every subscriber was then notified to visit the office and view the telephone display with a view toward selecting the type he or she liked best. This plan met with instant approval and in a comparatively few days every telephone user in town had made a choice. Many people who previously did not have a telephone were induced by this attractive display to order an instrument for immediate installation in their home. Many new extensions were also sold through the display of extension sets with the other telephones.

The most popular instrument was the Masterphone desk set. Even though the rate was higher for the Masterphone, the majority of people chose it in preference to all the others for both business and residential use. All of which proves again that a modernly designed, attractive telephone is the best possible sales appeal that can be used when selling telephone service.

As a result of the display, the Assumption Mutual Telephone Company, has accomplished several things. It enabled the company to give every subscriber the type of instrument that satisfied him best. It helped the company build a closer bond of friendship between itself and its patrons by showing that it was interested in pleasing them. And finally it sold many people new telephones or extensions, who in all probability would never have had them but for the public display. All in all, the plan proved to be tremendously worth while and might well be emulated by other telephone companies under similar circumstances.

BE A TIGHT WAD

Faith and favoritism won't put black figures in a financial statement.

Proof of performance at the lowest cost counts.

Have a showdown on everything.

Batteries cease to be trifles when you multiply them by the number of your stations, the number of replacements, and then add the installation costs.

No respectable Battery is priced lower than GENERAL STORM KING DURO POWR and NO OTHER Battery makes this offer of

PROOF

Hook up a GENERAL STORM KING DURO POWR Telephone Battery with any other cell. Date both. When replacement is needed, test each cell. If STORM KING is not superior, we will refund its cost.

General Dry Batteries, Inc.

CLEVELAND, O.

General Dry Batteries of Canada, Ltd., Toronto, Canada

Makers of all types of dependable Dry Batteries for Radio, Ignition, Flashlight and General Use.

RECONSTRUCTION OF SHANGHAI SYSTEM

(*Continued from page* 11)

involved the running of a new feeder cable from the new exchange to a convenient point where it could be teed into the old cable. With this method the subscriber's line terminated at both the old and the new exchanges.

This work alone involved the use of 570 miles of cross-connecting wire on the new and old central office main distribution frames.

Staff Training

The training of staff required special consideration, personnel with a knowledge of telephone practice being difficult to recruit. Steps had to be taken to train new recruits in the various types of work, and also to train the existing staff concerning new methods and the new standards which it was desired to obtain.

More than 700 men have passed through our Telephone Training School, receiving courses the duration of which varied from one week to three months, while approximately 500 men including 152 foreigners have received tuition at evening classes in the same school. In addition much training work was done in the field.

Instruction of Subscribers

For this very necessary and important part of the programme, special arrangements had to be made. A staff of 46 persons took care of the instruction of subscribers. The number of visits and revisits to subscribers made by this section up to the present time total 30,530.

Demonstration offices were established in various parts of the city, and subscribers were invited to attend these offices in order to receive demonstrations and practice in the use of the automatic telephone. Up to the present time 17,250 persons have taken advantage of this invitation.

The actual cut-over operation, which is more commonly referred to as the "Cut-over," consisted of cutting out the old and cutting in the new exchange. There are several places where this might be done, *e.g.*, old underground cables or internal cables leading to the old switchboard might be sawn off. This method is not ideal, for, in addition to the time factor, it is attended by some degree of risk through faults developing during the operation. The method adopted in Shanghai has been to cut out the old exchange by the removal of heat coils or line fuses on the old distribution frame, and cut in the new exchange by the removal of insulating pegs from the line test jacks on the new distribution frame. These insulating pegs were designed and made in Shanghai and permit of a record rapid removal.

The cut-over of Fokien Exchange involved the removal of more than 7,500 heat coils and 4,000 insulating pegs; this operation was made in three minutes. The number of retests made totalled 8,000.

Schedules

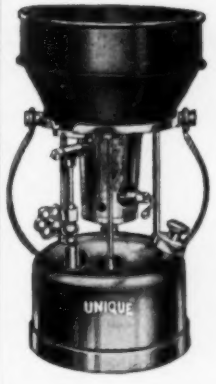
The success of an automatic system depends largely upon intelligent use by the subscriber; that is, on the proper observance of the tones or signals provided during the setting up of a call, the correct methods of dialling,—and generally, using the instrument according to the instructions provided.

In Shanghai at the present time, of 300,000 calls originated, 77.4 per cent result in conversations, 18.6 per cent find the subscriber busy or receive no reply.

Approximately 3.2 per cent of the total attempts made are abortive due to the subscriber abandoning the call, while only 0.8 per cent are due to equipment failure.

NEW EXCHANGE BUILDING FOR UNION, MO.

The Scotia Telephone company moved into its new brick building about the first of July, at which time it was cut over to common battery. The cost of building and installing the new equipment was approximately $25,000.00.



TEN MINUTES

to melt 50 pounds of solder! Couple this feature to the strength and simple design of all UNIQUES — and you have the reason it's preferred in the telephone field. We'll send it on trial. Write—

UNIQUE

Manufacturing Co.
225 Whiting St.
Chicago, Illinois

Devotes Ad Space to Unemployed

"Help Unemployment by Purchasing U. S. Products Made by U. S. Labor," Suggests Prominent Manufacturer

Readers of many national magazines and trade publications will, beginning this month, find the above sentence prominently displayed in heavy type in the body of advertisements signed by the Kester Solder Company. The appearance of this message in costly paid space signalizes the beginning of a constructive movement inaugurated by the Kester Solder Company, the largest manufacturers of flux-core solder in the United States.

"The idea of urging the purchase of U. S. made products is not, in itself new," said F. C. Engelhart, President of the Kester Solder Company, in explaining the plan, "But almost always, in the past, these efforts have been in connection with a particular product only, and, therefore, have lost much of their sincerity and effectiveness because the public sensed that the advertiser was merely taking a new means of endeavoring to sell his own product.

"In our own case, we have virtually no foreign competition. Practically all the flux-core solder used in this country is made in America and by far the largest single percentage of it is sold by our own company. Therefore, we, ourselves, have little to gain directly. Our idea is simply to help unemployment generally throughout the United States by urging the purchase of products of any and every kind that are made in the United States by American labor. Naturally, we, together with every other organization, will benefit from the growth of such a movement.

"We believe that if a large number of American manufacturers and retailers adopt and use this slogan in their advertising, it will have an important effect on the unemployment situation. A number of prominent manufacturers have already complimented us on the idea, as well as numerous editors, Associations of Commerce and public spirited men.

"We devote approximately one-fourteenth of our total advertising space to this message. What this means in dollars and cents, we haven't stopped to figure out—though it comes to a respectable sum. We are simply glad that our extensive advertising schedule enables us to broadcast this constructive message to such a vast army of readers and hope that other patriotic advertisers will do likewise. The effect on the public, we feel sure, will be beneficial to everyone."

HAMLER, OHIO, ORDERS "ALL-RELAY" AUTOMATIC

Geo. B. Quatman of The Telephone Engineering and Management company has announced the purchase of an "All-Relay" automatic switchboard by the Citizens' Exchange Telephone Co. for installation at Hamler, Ohio. The installation of the "All-Relay" switchboard will complete the rehabilitation of this property.

This switchboard will serve four hundred subscribers in the southern part of Henry county, a progressive agricultural district of northwestern Ohio. The service will be dial automatic with 10 party full selective ringing. The compensated line equipment will be used, thus providing unlimited reverting call facilities and automatic clearance of line faults. The toll traffic will be switched on the automanual tall board at Napoleon, the county seat, seventeen miles distant. Five direct trunks will also connect Hamler with Holgate, a nearby village.

The Hamler switchboard when completed will be the tenth "All-Relay" switchboard under Mr. Quatman's management. Mr. Quatman is general manager of the Telephone Engineering & Management company and has under his supervision and management, a number of companies operating some fifty exchanges, and is a prominent engineer in New York, Ohio and the Carolina districts.

The "All-Relay" switchboard was purchased from The North Electric Mfg. Company and will be put into service early this fall.

WHY TELEPHONE RATES CANNOT BE REDUCED

The best answer we have found to this question is taken from a recent order of the Alabama Public Service Commission, dismissing a complaint against the rates of the Birmingham Gas Company. The following excerpt from the Commission's order tells the story: "Were the utilities unregulated as is true of private enterprises, if they were free during prosperous times to fix rates without regulatory control, then they could with justice, perhaps, be subjected to the price fluctuations suffered by private business during economic depressions. If however, they have not been permitted to earn more than a fair return during prosperous times, this fact must be given due consideration when we deal with their rates and their rate of return during periods of general business depression. It must be apparent, therefore, to every thinking man that public utilities can not be subjected to the sharp price fluctuations which are incident to private business."

TALKING CLOCK

A talking clock which will answer telephone requests for the correct time may be installed in the future in Paris telephone exchanges. It consists of a synchronized revolving drum with three series of indicators—hours, minutes and seconds. A sound producing film alongside the drum gives out the right time in sound.

WRIT HALTS RATE REDUCTION OF WISCONSIN TELEPHONE CO.

Milwaukee.—Judge F. A. Geiger has granted an injunction in federal court here to Wisconsin Telephone Company enjoining the Wisconsin public service commission from enforcing the decree which ordered a reduction of 12½ per cent in the company's service rate. Hearing of the case has been set for August 20.

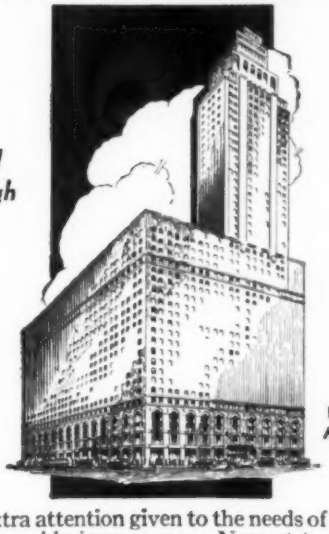
We wish to announce to our patrons that we have moved our offices to 185 N. Wabash Ave., Chicago, Illinois

We are continuing with the same policies of service to our clients that have proved so popular with the telephone industry.

BOWDLE ACCOUNTING SYSTEM

Room 1218, 185 N. Wabash Ave., Chicago, Ill.

IN CHICAGO



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Managing Director

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2500 ROOMS $3.00 UP

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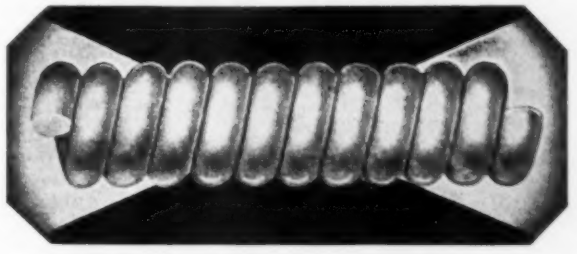

Galvanized Telephone Wire and Steel Strand

Crapo Galvanized Wire can be wrapped around its own diameter without injury to its pure zinc coating.... That is one of a number of reasons why **Crapo** Galvanized Telephone Wire and Strand can be depended upon to reduce maintenance cost.

Look for the **Crapo** Seal!

Indiana Steel & Wire Co.
Muncie, Indiana

INDIANA STEEL & WIRE CO. Crapo Galvanizing MUNCIE IND.

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GALVANIZED PRODUCTS

TELEPHONE EXECUTIVES

Here **IS** *a buy*

$2 PER DAY

Buys a comfortable Room with bath at the

PICKWICK ARMS HOTEL

on the East Side convenient to Grand Central Club facilities, with completely equipped Gymnasium

RATES		
	WEEKLY	$10-$21
	LUNCHEON	55c
	DINNER	75c

Pickwick Arms

A MODERN 400 ROOM HOTEL

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The AMERICAN HOTEL
275 ROOMS WITH BATH
$2.00 up

The ANNEX
226 ROOMS WITH BATH
$1.50 Up

The AMERICAN HOTEL
MARKET AT SEVENTH

The AMERICAN ANNEX
MARKET AT SIXTH

Our Food has made our Reputation
COFFEE SHOP OPEN UNTIL MIDNIGHT

With Manufacturers and Jobbers

INSTALLS STROMBERG-CARLSON SWITCHBOARD

The Nine Mile Telephone Company of Nine Mile, Indiana, has just installed a No. 105 Stromberg-Carlson Switchboard in its exchange.

So efficiently has the new switchboard operated that subscribers served by the Nine Mile company have praised R. H. Minich, manager, for providing them up-to-date service.

Satisfaction in the new telephone system is expressed in the following letter written to Paul D. Myers, Inc., Stromberg-Carlson representative in Indiana, by Mr. Minich:

Mrs. R. H. Minich at the new switchboard recently installed in the Nine Mile Telephone Co., Nine Mile, Indiana. R. H. is seen standing in the background.

> "The No. 105 Stromberg-Carlson Switchboard is very satisfactory. The telephone users have noticed the improvement in their telephone service and have mentioned it to us. We think that it is the finest switchboard on the market."

The new switchboard replaced another Stromberg-Carlson board installed 18 years ago.

Mr. Minich has managed the telephone company for 27 years and Mrs. Minich has been operator for the same number of years.

MASTERBUILT SWITCHBOARD FOR BLUFF CITY, TENN.

A new 1-position Masterbuilt switchboard was recently purchased by the Inter-Mountain Telephone Company for installation at its Bluff City, Tennessee exchange. Since 1926 when the property was taken over by Mr. W. N. McAnge, Jr., president of the Inter-Mountain Company, a definite plan for improving and modernizing the exchange has been followed, culminating in the recent purchase of a Kellogg 6-800 Masterbuilt switchboard assuring Bluff City the fastest, most modern, service possible.

The Bluff City exchange now has magneto service which will be converted to common battery when the new switchboard is installed. Subscribers were consulted before the board was purchased to determine what type of service they wanted. The choice of common battery equipment was almost unanimous.

NAMED ON ROCHESTER GAS & ELECTRIC CORP. BOARD

W. Roy McCanne, president and general manager of the Stromberg-Carlson Telephone Manufacturing Company and John P. Boylan, president of the Rochester Telephone Corporation, are among the eleven Rochester business men and bankers recently named on the new board of Rochester Gas and Electric Corporation following the turning over of control to Rochester interests by Associated Gas and Electric Corporation.

FWD APPOINTS ART ENGINEER

E. K. Bard has been appointed to the position of art engineer by the Four Wheel Drive Auto Company of Clintonville, Wisconsin. Bard, a commercial artist and engineer, has been a member of the FWD engineering staff for the past three years, during which time he has contributed materially to the improved appearance of the present line. His new position will enable him to devote all of his time to this phase of design as well as offer a consulting service for customers on improving the appearance of their trucks. Color combinations, lettering layout and special finishes will be directly under the supervision of Mr. Bard.

E. K. Bard, recently appointed art engineer for the Four-Wheel Drive Auto Company.

"ALL-RELAY" SWITCHBOARD IS PURCHASED FOR CROSS HILL, SOUTH CAROLINA

The Home Telephone company of Cross Hill, S. C., was recently granted incorporation papers authorizing it to conduct a telephone system at Cross Hill and elsewhere. This corporation is to operate in the territory formerly served by the Cross Hill Telephone company.

C. B. Barksdale, treasurer of the Home Telephone company of Cross Hill, S. C., has announced extensive plans for improvement of the exchange at Cross Hill. These improvements include the complete reconditioning of lines, the erection of an exchange building and the installation of "All-Relay" automatic central office equipment.

The cutover to the new plant and equipment is scheduled for September, and when completed will put this exchange on an operating basis, that is said to be ideal for small or isolated areas.

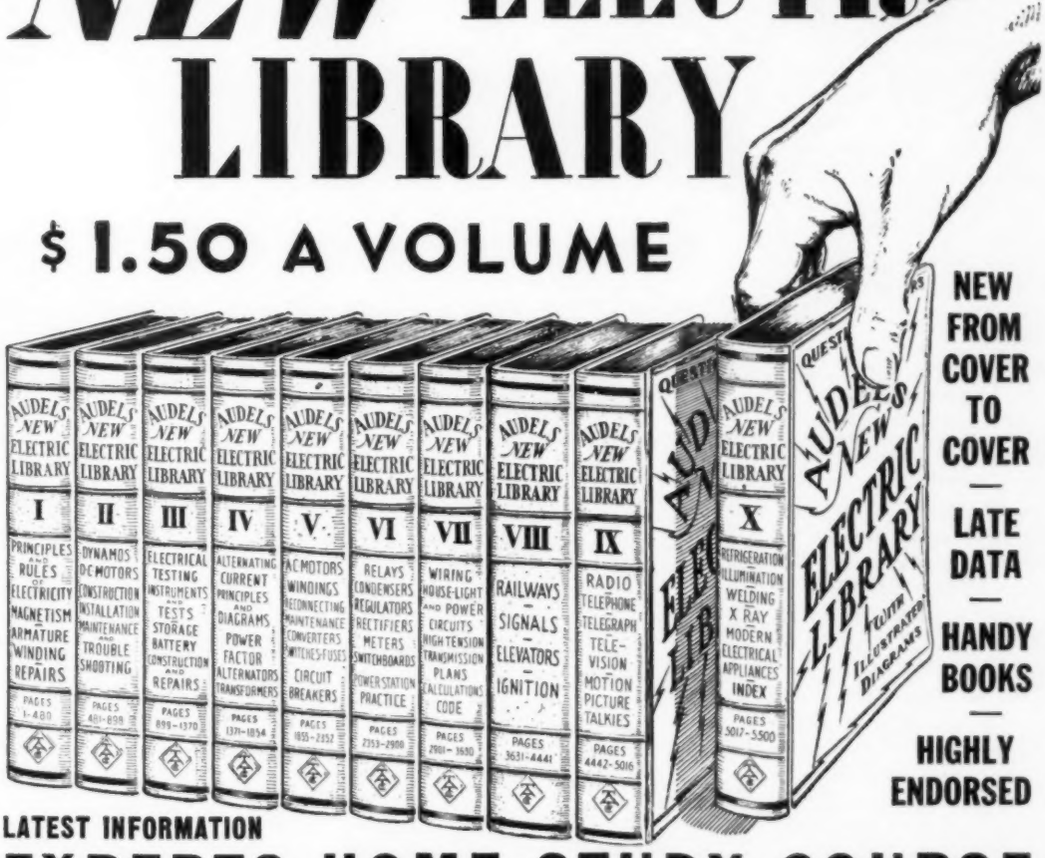
The "All-Relay" switchboard has been ordered from the North Electric Mfg. Company and will provide dial automatic service with full selective 10 party harmonic ringing and all the service facilities of a modern city exchange. The exchange will be unattended and for this reason will be equipped with the latest improvements for the automatic handling of line faults under adverse weather conditions.

The toll traffic will be handled by the Greenwood Telephone Company at Greenwood, S. C., ten miles distant from Cross Hill.

The officers of the newly organized company are George A. Barksdale, president, J. W. Sproles and J. S. Barley are vice presidents and C. Bruce Barksdale is secretary and treasurer. These gentlemen are also identified with the Greenwood Telephone company.

NEW ELECTRIC LIBRARY

$1.50 A VOLUME


AUDELS NEW ELECTRIC LIBRARY
I PRINCIPLES AND RULES OF ELECTRICITY MAGNETISM ARMATURE WINDING REPAIRS
II DYNAMOS DC MOTORS CONSTRUCTION INSTALLATION MAINTENANCE AND TROUBLE SHOOTING
III ELECTRICAL TESTING INSTRUMENTS AND TESTS STORAGE BATTERY CONSTRUCTION AND REPAIRS
IV ALTERNATING CURRENT PRINCIPLES AND DIAGRAMS POWER FACTOR ALTERNATORS TRANSFORMERS
V AC MOTORS WINDINGS RECONNECTING MAINTENANCE CONVERTERS WITCHES FUSES CIRCUIT BREAKERS
VI RELAYS CONDENSERS REGULATORS RECTIFIERS METERS SWITCHBOARDS POWER STATION PRACTICE
VII WIRING HOUSE-LIGHT AND POWER CIRCUITS HIGH TENSION TRANSMISSION PLANS CALCULATIONS CODE
VIII RAILWAYS SIGNALS ELEVATORS IGNITION
IX RADIO TELEPHONE TELEGRAPH TELEVISION MOTION PICTURE TALKIES
X REFRIGERATION ILLUMINATION WELDING X RAY MODERN ELECTRICAL APPLIANCES INDEX
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LATEST INFORMATION

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Audels New Electric Library is an entirely new reference Series for engineers, electrical workers, mechanics, maintenance, service men and students. 10 pocket Hand Books, containing 5690 pages—9056 illustrations and diagrams—full information on the latest applications of electricity.

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T. E.

UP-STATE ASSOCIATION ELECTS OFFICERS

The organization meeting of the Up-State Telephone Association was held at the Rochester Club, Rochester, N. Y., Friday, July 1st, 1932, at noon. The entire board of directors were in attendance.

John H. Wright, of Jamestown, N. Y., was elected temporary chairman and John Troy, of Rhineback, N. Y., was elected temporary secretary.

The following officers were elected: John P. Boylan, Rochester, president; J. G. Ihmsen, Albany, N. Y., vice-president and general manager; Charles M. Beattie, Rochester, N. Y., treasurer; H. H. Griswold, Phelps, N. Y., secretary; F. J. Brookman, Rochester, N. Y., assistant secretary; S. G. Bowie, Rochester, N. Y., assistant treasurer.

Executive committee: John P. Boylan, Rochester, J. G. Ihmsen, Albany, H. H. Griswold, Phelps.

SOUTHWEST TELEPHONE ASKS TO EXTEND DEBENTURES

Chester H. Loveland, president of the Southwest Telephone Company has asked holders of $650,000, 6 per cent series A, convertible debentures of his company, maturing December 1, 1932, to consent to a five year extension because of anticipated impossibility of refunding these securities at maturity.

Net earnings for twelve months ending April 30, 1932, are shown as $275,841 with a balance of $60,726 after all interest requirements.

Holders of the debentures are asked to deposit them with the Central Republic Bank and Trust Company for the proposed extension. Interest for the period of extension is increased to 6½ per cent and a bonus of ½ per cent is offered on all deposits between now and December 1, next.

TELEPHONE EARNINGS FOR FIRST SIX MONTHS

The American Telephone and Telegraph Company report for the first six months of this year shows net income of $75,099,345, against $89,213,356 in the corresponding period of 1931. The six months' earnings were equal to $4.02 a share on 18,658,361 shares of outstanding stock.

Total earnings were $130,846,788, against $150,379,198 in the same 1931 period. After dividend payments, the company had a deficit for the half year of $875,020, against a balance one year ago of $9,331,270.

WOULD LIKE EMPLOYMENT IN FOREIGN COUNTRY

Telephone Engineer is in receipt of a letter from a gentleman in New York who seeks employment in some foreign country. He states in his letter that he has held positions as construction foreman, lineman, and is a graduate of the U. S. Army Signal school, with several years experience in telephone work in different lines.

This gentleman feels he is competent to hold any job in the exchange or outside, and now seeks work in the United States or foreign country. He is only 25 years of age, single, healthy and willing to go anywhere.

If any telephone company wishes the address of this gentleman we will be glad to turn such letters over to him for direct correspondence.

POSITION WANTED

Married man with 11 years experience would like to hear of available position as lineman, trouble shooter or local manager.

Can furnish bond and good reference. Write AG, c/o TEL. ENG.

TELEPHONES INCREASE IN NUMBER

Within the past year the number of telephone subscribers in Fox River Grove, Ill., has increased over fifteen per cent, bringing the total to about 115. A gradual stepping up in the list of names has been noted with each succeeding directory issued.

RECONSTRUCTED EQUIPMENT

Kellogg No. 30A 100 ohm combine line drops and jacks 10 per strip @	$10.00
Any Make Transmitter repaired and enameled @	.50
Any Make Receiver unit repaired (Bobbins rewound) @	.45
Western Elec. No. 315 3-bar 1000-1600 or 2500 ohm Monophone signal sets @	5.00
Stromberg 4-bar 1000-1600 or 2500 ohm Monophone signal sets @	5.50
New Cabinet 5-bar 1000-1600 or 2500 ohm Monophone signal sets @	6.25
Kellogg latest type unbreakable desk set with 3-bar 1000-1600 or 2500 ohm inside connection signal set @ $10.00—4-bar @ $10.50—5-bar @	11.00
Western Elec. No. 329 or Kellogg No. 22 Transmitters with back @	1.10
Western Elec. No. 317 3-bar 1000 ohm Bdg. compacts with 3 inch gong ringers @	6.60
Cook No. 8 Arresters with heat coils per bank of 20 lines @	6.50
Used 3 conductor desk set cords with clips of tips both ends @	.25
Strombery New No. 53x Plugs with new 6 foot cords attached @	.75
New Western Elec. No. 143 Rec. Shells with caps @	.37
Kellogg, Dean or Monarch 100 ohm drop coils @ 35c—500 ohm 45c—1000 ohm @	.50
Stromberg No. 11 combine line drops and jacks per strip of 5 @	7.00
Stromberg No. 11 350 ohm drop coils @	.45
Kellogg No. 51E ring off drops 10 per strip @	8.00

Write for Bulletins

REBUILT ELECTRIC EQUIPMENT CO.
1940 W. 21st St., Pilsen Station, Chicago, Ill.

J. G. WRAY & CO.
Telephone Engineers
Specialists in Appraisals, Rate Surveys, Financial Investigations, Organization and Operation of Telephone Companies
J. G. Wray, Fellow A. I. E. E.
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Rm. 2626 Bankers Bldg., Chicago

REBUILT
Telephone Apparatus and Exchange Equipment Saves You 30 to 50 Per Cent—Without Sacrificing Quality or Efficiency in the Least.

WHY BECAUSE it is all up-to-date in design — of the best and most reputable manufacture — and is in most cases generally better than the majority of equipment you now have in service.

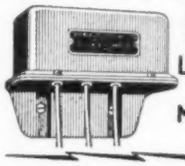
Our Stock Is Immense — Magneto or Common Battery — including Switchboards — Switchboard Apparatus — Telephones — Protection Equipment — Cable — everything you need for the installation of a new exchange or maintaining your present one.

Twenty Years Successful Operation of this Department in connection with our business puts it past the experimental state — Quality and Price have made our customers permanent — it will pay YOU to investigate.

Ask for Free Bulletin. Address
PREMIER ELECTRIC COMPANY
3800-3810 Ravenswood Ave.,
CHICAGO, ILL.
"Rebuilt" when connected with Premier means something.

COFFEY SYSTEM & AUDIT CO.
Exclusive telephone accounting since 1907.
Certified Public Accountants.
We install the well-known
COFFEY SYSTEM
Audits—Rate Cases and Special Work.
A Central Accounting Department.
454 Consolidated Bldg., Indianapolis, Ind.

ACCOUNTING
HERDRICH AND BOGGS
Certified Public Accountants
Specializing in Telephone Accounting and Rate Cases Since 1918.
901-7 Continental Bank Bldg.
Indianapolis, Indiana



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MINNEAPOLIS, MINN.

New Unprotected Cable Terminals

W. E. 14-B 11 pair with stub	$4.50
Cook M-10-1 16 pair	3.00
Cook M-10-1 16 pair with stub	5.50
Cook M-10-1 26 pair	5.00
Reliable Elec. Co. 2-A substation protectors similar to No. 977 type	.60

Buckeye Telephone & Supply Company
COLUMBUS, OHIO